

CSHQA

VOLUME ONE

PROJECT MANUAL

For

DEPARTMENT OF VETERANS AFFAIRS

500 West Fort Street
Boise, ID 83702

New Extended Care
Unit Buildings
'A' and 'B' CLC

VA Project No. 531-319
Project No. 10101.000

December 1, 2011

Department of
Veterans Affairs
500 West Fort Street
Boise, Idaho 83702

**FOR CONSTRUCTION
SET**

THIS PAGE INTENTIONALLY LEFT BLANK

DEPARTMENT OF VETERANS AFFAIRS
NEW EXTENDED CARE UNIT
BUILDING 'A' AND 'B' CLC

VA PROJ. NO. 531-319

PROJECT MANUAL

Boise, Idaho
December 1, 2011

FOR CONSTRUCTION SET

Owner: Dept of Veterans Affairs
Medical Center
500 West Fort Street
Boise, Idaho 83702

Shawn Flagstad, COTR

Tel: (208) 422-1000 x 4405 E-
mail: shawn.flagstad@va.gov



Architectural: CSHQA
250 S. 5th Street
Boise, Idaho 83702

John D. Maulin, AIA
Tel: (208) 343-4635

E-mail: john_maulin@csqqa.com



Civil: CSHQA
250 S. 5th Street
Boise, Idaho 83702

John Geraud, PE, LEED AP
Tel: (208) 343-4635

E-mail: john.geraud@csqqa.com



Structural: AHJ Engineers, P.C.
5418 N. Eagle Road #140
Boise, Idaho 83713

David Haugland, PE, SE
Tel: (208) 323-0199

E-mail: dhaugland@ahjengineers.com



Mechanical: CSHQA
250 S. 5th Street
Boise, Idaho 83702

Steve Hardy, PE
Tel: (208) 343-4635
E-mail: steve.hardy@cshqa.com



Electrical/
Communications: CSHQA
250 S. 5th Street
Boise, Idaho 83702

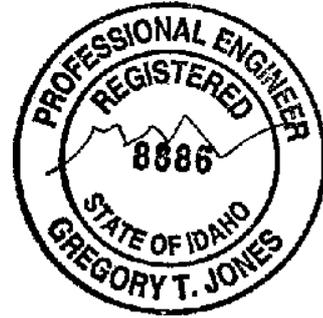
Amy Dockter, PE
Tel: (208) 343-4635
E-mail: amy.dockter@cshqa.com



Landscape Arch: CSHQA
250 S. 5th Street
Boise, Idaho 83702

Kyle Hemly, ASLA, CLARB
Tel: (208) 343-4635
E-mail: kyle.hemly@cshqa.com

Fire Protection: Protection Consultants, Inc.
1199 S. Main Street, Suite
101 Centerville, Utah 84014



la/i/li

Greg T. Jones, FPE
Tel: (801) 295-6070 x 2
E-mail: greg@pciut.com

DEPARTMENT OF VETERANS AFFAIRS
VHA MASTER SPECIFICATIONS

TABLE OF CONTENTS
Section 00 01 10

VOLUME ONE		
	DIVISION 00 - SPECIAL SECTIONS	DATE
00 00 00	Project Directory	
00 01 10	Table of Contents	
00 01 15	List of Drawing Sheets	10-07
00 11 22	Geotechnical Engineering Report	
	DIVISION 01 - GENERAL REQUIREMENTS	
01 00 00	General Requirements	04-11
01 01 50	OSHA Requirements and Safety Health Relations	05-11
01 33 23	Shop Drawings, Product Data, and Samples	11-08
01 42 19	Reference Standards	11-08
01 45 29	Testing Laboratory Services	05-08
01 57 19	Temporary Environmental Controls	01-11
01 74 19	Construction Waste Management	09-10
01 91 00	General Commissioning Requirements	05-11
	DIVISION 02 - EXISTING CONDITIONS	
02 41 00	Demolition	06-10
02 82 13.41	Asbestos Abatement For Total Demolition Projects	07-11
	DIVISION 03 - CONCRETE	
03 30 00	Cast-in-Place Concrete	03-11
	DIVISION 04 - MASONRY	
04 05 13	Masonry Mortaring	08-08
04 20 00	Unit Masonry	08-08
04 72 00	Cast Stone Masonry	08-08
	DIVISION 05 - METALS	
05 12 00	Structural Steel Framing	10-06
05 21 00	Steel Joist Framing	03-10
05 31 00	Steel Decking	11-08
05 36 00	Composite Metal Decking	12-05
05 40 00	Cold-Formed Metal Framing	05-04
05 50 00	Metal Fabrications	10-07
05 51 00	Metal Stairs	10-07
	DIVISION 06 - WOOD, PLASTICS AND COMPOSITES	
06 10 00	Rough Carpentry	10-07
06 20 00	Finish Carpentry	05-10
06 61 40	Composite Surfacing	
06 61 41	Architectural Composite Columns	
06 61 42	Architectural Wood Columns	

DIVISION 07 - THERMAL AND MOISTURE PROTECTION		
07 11 13	Bituminous Damp proofing	10-08
07 13 52	Modified Bituminous Sheet Waterproofing	09-11
07 19 00	Water Repellents	02-10
07 21 13	Thermal Insulation	03-09
07 25 00	Weather Barriers	02-10
07 31 13	Asphalt Shingles	10-08
07 54 23	Thermoplastic Polyolefin (TPO) Roofing	10-10
07 60 00	Flashing and Sheet Metal	10-10
07 71 20	Aluminum Cornice	
07 81 00	Applied Fireproofing	12-08
07 81 23	Intumescent Mastic Fireproofing	02-10
07 84 00	Firestopping	08-08
07 92 00	Joint Sealants	02-11
DIVISION 08 - OPENINGS		
08 11 13	Hollow Metal Doors and Frames	02-09
08 14 00	Wood Doors	01-10
08 31 13	Access Doors and Frames	10-07
08 33 00	Coiling Doors and Grilles	10-07
08 52 00	Wood Windows	
08 71 00	Door Hardware	02-11
08 71 13.11	Low Energy Power Assist Door Operators	01-11
08 80 00	Glazing	12-10
08 90 00	Louvers and Vents	01-08
DIVISION 09 - FINISHES		
09 22 16	Non-Structural Metal Framing	07-10
09 24 00	Portland Cement Plastering	02-08
09 29 00	Gypsum Board	09-10
09 30 13	Ceramic/Porcelain Tiling	03-09
09 51 00	Acoustical Ceilings	10-10
09 65 13	Resilient Base and Accessories	04-08
09 65 16	Resilient Sheet Flooring	07-10
09 68 00	Carpeting	08-08
09 72 16	Vinyl-Coated Fabric Wall Coverings	11-07
09 77 00	Prefinished Panels	07-06
09 77 50	Fiberglass Reinforced Panels	10-09
09 91 00	Painting	06-02
DIVISION 10 - SPECIALTIES		
10 11 13	Markerboards	06-10
10 11 23	Tackboards	10-07
10 14 00	Signage	06-08
10 21 23	Cubicle Curtain Tracks	02-08
10 25 13	Patient and Service Walls	08-08
10 26 00	Wall and Door Protection	01-11
10 28 00	Toilet, Bath, and Laundry Accessories	02-08
10 44 13	Fire Extinguisher Cabinets	10-07

	DIVISION 11 - EQUIPMENT	
11 44 00	Equipment	08-08
11 73 00	Ceiling Mounted Patient Lift System	07-10
	DIVISION 12 - FURNISHINGS	
12 24 00	Window Shades	02-08
12 24 21	Lightproof Shades	02-08
	DIVISION 13 - SPECIAL CONSTRUCTION	
13 05 41	Seismic Restraint Requirements for Non-Structural Components	12-07
	DIVISION 14- CONVEYING EQUIPEMENT	
14 24 00	Hydraulic Elevators	09-08
VOLUME TWO		
	DIVISION 21- FIRE SUPPRESSION	
21 05 11	Common Work Results for Fire Suppression	11-09
21 13 13	Wet-Pipe Sprinkler Systems	05-08
	DIVISION 22 - PLUMBING	
22 05 11	Common Work Results for Plumbing	04-11
22 05 12	General Motor Requirements for Plumbing Equipment	12-09
22 05 19	Meters and Gages for Plumbing Piping	02-10
22 05 23	General-Duty Valves for Plumbing Piping	12-09
22 07 11	Plumbing Insulation	05-11
22 11 00	Facility Water Distribution	10-06
22 11 23	Domestic Water Pumps	11-10
22 13 00	Facility Sanitary and Vent Piping	12-09
22 14 00	Facility Storm Drainage	12-09
22 35 00	Domestic Water Heat Exchangers	02-10
22 40 00	Plumbing Fixtures	03-11
22 63 00	Gas Systems for Laboratory and Healthcare Facilities	12-10
	DIVISION 23 - HEATING, VENTILATING, AND AIR CONDITIONING (HVAC)	
23 05 11	Common Work Results for HVAC	11-10
23 05 12	General Motor Requirements for HVAC and Steam Generation Equipment	11-10
23 05 41	Noise and Vibration Control for HVAC Piping and Equipment	11-10
23 05 93	Testing, Adjusting, and Balancing for HVAC	12-06
23 07 11	HVAC, Plumbing, and Boiler Plant Insulation	12-06
23 08 00	Commissioning of HVAC Systems	07-10
23 09 23	Direct-Digital Control System for HVAC	04-11
23 21 13	Hydronic Piping	03-10

23 21 23	Hydronic Pumps	02-10
23 25 00	HVAC Water Treatment	02-10
23 31 00	HVAC Ducts and Casings	04-11
23 37 00	Air Outlets and Inlets	11-09
23 40 00	HVAC Air Cleaning Devices	05-11
23 64 00	Packaged Water Chillers	04-11
23 72 00	Air-To-Air Energy Recovery Equipment	05-11
23 82 00	Convection Heating and Cooling Units	04-11
23 82 16	Air Coils	04-11
	DIVISION 26 - ELECTRICAL	
26 05 11	Requirements for Electrical Installations	09-10
26 05 13	Medium-Voltage Cables	09-10
26 05 21	Low-Voltage Electrical Power Conductors and (600 Cables Volts and Below)	09-10
26 05 26	Grounding and Bonding for Electrical Systems	09-10
26 05 33	Raceway and Boxes for Electrical Systems	09-10
26 05 41	Underground Electrical Construction	09-10
26 12 19	Pad-Mounted, Liquid-Filled, Medium-Voltage Transformers	09-10
26 24 11	Distribution Switchboards	04-09
26 24 16	Panelboards	09-10
26 27 26	Wiring Devices	04-09
26 29 11	Motor Starters	09-10
26 29 21	Disconnect Switches	09-10
26 43 13	Transient-Voltage Surge Suppression	04-09
26 51 00	Interior Lighting	04-09
26 56 00	Exterior Lighting	09-10
	DIVISION 27 - COMMUNICATIONS	
27 05 11	Requirements for Communications Installations	11-09
27 05 26	Grounding and Bonding for Communications Systems	10-06
27 05 33	Raceways and Boxes for Communications Systems	12-05
27 10 00	Structured Cabling	12-05
27 11 00	Communications Equipment Room Fittings	10-06
27 15 00	Communications Horizontal Cabling	10-06
27 41 31	Master Antenna Television Equipment and Systems	08-09
27 52 23	Nurse Call and Code Blue Systems	01-10
27 52 41	Patient Wander Protection System	
	DIVISION 28 - ELECTRONIC SAFETY AND SECURITY	
28 05 11	Requirements for Electronic Safety and Security Installations	04-11
28 05 13	Conductors and Cables for Electronic Safety and Security	12-05
28 05 26	Grounding and Bonding for Electronic Safety and Security	10-06
28 05 33	Raceways and Boxes for Electronic Safety and Security	12-05
28 08 00	Commissioning of Electronic Safety and Security Systems	07-10
28 13 16	Access Control Systems and Database Management	11-09
28 26 00	Electronic Personal Protection System (EPPS)	11-09
28 31 00	Fire Detection and Alarm	09-05

	DIVISION 31 - EARTHWORK	
31 20 11	Earth Moving (Short Form)	09-08
31 23 19	Dewatering	12-05
	DIVISION 32 - EXTERIOR IMPROVEMENTS	
32 05 23	Cement and Concrete for Exterior Improvements	12-05
32 12 16	Asphalt Paving	11-05
32 84 00	Planting Irrigation	04-10
32 93 00	Plants	09-08
	DIVISION 33 - UTILITIES	
33 10 00	Water Utilities	12-05
33 30 00	Sanitary Sewerage Utilities	10-06
33 40 00	Storm Drainage Utilities	11-05

THIS PAGE INTENTIONALLY LEFT BLANK

SECTION 00 01 15
LIST OF DRAWING SHEETS

The drawings listed below accompanying this specification form a part of the contract.

BUILDING 'A'

Drawing No. Title

GENERAL

AG1.0 TITLE SHEET
AG1.1 LIFE SAFETY PLAN

ARCHITECTURAL

AA1.0 FLOOR PLANS
AA1.1 DIMENSION PLANS
AA1.2 ENLARGED FLOOR PLANS
AA2.0 ROOF PLAN
AA3.0 EXTERIOR ELEVATIONS
AA4.0 SECTIONS
AA6.0 ROOM FINISH SCHEDULE
AA6.1 FURNITURE AND EQUIPMENT PLAN /SCHEDULES
AA6.2 DOOR SCHEDULE AND WINDOW TYPES
AA7.0 BUILDING DETAILS
AA7.1 BUILDING DETAILS
AA7.2 BUILDING DETAILS
AA7.3 BUILDING DETAILS
AA7.4 BUILDING DETAILS
AA8.0 INTERIOR ELEVATIONS
AA8.1 INTERIOR ELEVATIONS
AA9.0 REFLECTED CEILING PLANS

STRUCTURAL

AS0.1 GENERAL STRUCTURAL NOTES
AS2.0 FOUNDATION PLAN
AS2.1 ROOF FRAMING PLAN
AS3.0 STRUCTURAL DETAILS
AS3.1 STRUCTURAL DETAILS
AS3.2 STRUCTURAL DETAILS
AS3.3 STRUCTURAL DETAILS

MECHANICAL

AM0.1 MECHANICAL COVER SHEET
AM0.2 MECHANICAL SCHEDULES
AM2.1 HVAC PLAN
AM2.2 HVAC ROOF PLAN
AM2.3 HYDRONIC PLAN
AM3.1 HVAC DETAILS
AM3.2 HVAC DETAILS
AM3.3 HEATING WATER HYDRONIC SCHEMATIC
AM3.4 CHILLED WATER HYDRONIC SCHEMATIC
AM3.5 CONTROLS SCHEMATIC
AM3.6 CONTROLS SCHEMATIC

PLUMBING

AP0.1 PLUMBING COVER SHEET
 AP0.2 PLUMBING SCHEDULES
 AP2.0 SEWER AND VENT PLAN
 AP2.1 WATER AND OXYGEN PLAN
 AP2.2 ROOF PLUMBING PLAN
 AP3.0 PLUMBING DETAILS
 AP3.1 PLUMBING DETAILS

ELECTRICAL

AE0.1 ELECTRICAL LEGEND AND SYMBOLS
 AE0.2 LIGHTING SCHEDULES AND WIRING DIAGRAMS
 AE2.1 POWER PLAN
 AE2.2 LIGHTING PLAN
 AE2.3 MECHANICAL POWER PLAN
 AE2.4 ROOF POWER PLAN
 AE2.5 TELECOMMUNICATION PLAN
 AE3.1 SINGLE LINE DIAGRAM AND SCHEDULES
 AE3.2 TELECOMMUNICATION SCHEMATICS
 AE4.1 ELECTRICAL DETAILS
 AE4.2 TELECOMMUNICATION ROOM DETAILS

FIRE PROTECTION

AFP0.1 FIRE PROTECTION LEGEND AND SYMBOLS
 AFP2.1 FIRE ALARM PLAN
 AFP3.1 FIRE ALARM RISER DIAGRAM AND DETAILS

BUILDING 'B'

Drawing No. Title

GENERAL

BG1.0 TITLE SHEET
 BG1.1 LIFE SAFETY PLAN

ARCHITECTURAL

BA1.0 FIRST FLOOR PLAN
 BA1.1 SECOND FLOOR PLAN
 BA1.2 FIRST FLOOR DIMENSION PLAN
 BA1.3 SECOND FLOOR DIMENSION PLAN
 BA1.4 ENLARGED FLOOR PLANS
 BA1.5 ENLARGED FLOOR PLANS
 BA2.0 ROOF PLAN
 BA3.0 EXTERIOR ELEVATIONS
 BA4.0 BUILDING SECTIONS
 BA4.1 STAIR SECTIONS
 BA6.0 FIRST FLOOR ROOM FINISH SCHEDULE
 BA6.1 SECOND FLOOR ROOM FINISH SCHEDULE
 BA6.2 FIRST FLOOR FURNITURE AND EQUIPMENT PLAN/SCHEDULES
 BA6.3 SECOND FLOOR FURNITURE AND EQUIPMENT PLAN/SCHEDULES

BA6.4 DOOR SCHEDULE AND WINDOW TYPES
BA6.5 DOOR SCHEDULE
BA7.0 BUILDING DETAILS
BA7.1 BUILDING DETAILS
BA7.2 BUILDING DETAILS
BA7.3 BUILDING DETAILS
BA7.4 BUILDING DETAILS
BA7.5 BUILDING DETAILS
BA8.0 INTERIOR ELEVATIONS
BA8.1 INTERIOR ELEVATIONS
BA9.0 FIRST FLOOR REFLECTED CEILING PLAN
BA9.1 SECOND FLOOR REFLECTED CEILING PLAN

STRUCTURAL

BSO.1 GENERAL STRUCTURAL NOTES
BS2.0 FOUNDATION PLAN
BS2.1 SECOND FLOOR FRAMING PLAN
BS2.2 ROOF FRAMING PLAN
BS3.0 STRUCTURAL DETAILS
BS3.1 STRUCTURAL DETAILS
BS3.2 STRUCTURAL DETAILS
BS3.3 STRUCTURAL DETAILS
BS3.4 STRUCTURAL DETAILS

MECHANICAL

BM0.1 MECHANICAL COVER SHEET
BM0.2 MECHANICAL SCHEDULES
BM2.1 FIRST FLOOR HVAC PLAN
BM2.2 SECOND FLOOR HVAC PLAN
BM2.3 HVAC ROOF PLAN
BM2.4 FIRST FLOOR HYDRONIC PLAN
BM2.5 SECOND FLOOR HYDRONIC PLAN
BM3.1 HVAC DETAILS
BM3.2 HVAC DETAILS
BM3.3 HEATING WATER HYDRONIC SCHEMATIC
BM3.4 CHILLED WATER HYDRONIC SCHEMATIC
BM3.5 CONTROLS SCHEMATIC
BM3.6 CONTROLS SCHEMATIC

PLUMBING

BP0.1 PLUMBING COVER SHEET
BP0.2 PLUMBING SCHEDULES
BP2.0 FIRST FLOOR SEWER AND VENT PLAN
BP2.1 SECOND FLOOR SEWER AND VENT PLAN
BP2.2 FIRST FLOOR WATER AND OXYGEN PLAN
BP2.3 SECOND FLOOR WATER AND OXYGEN PLAN
BP2.4 ROOF PLUMBING PLAN
BP3.0 PLUMBING DETAILS
BP3.1 PLUMBING DETAILS

ELECTRICAL

BE0.1 ELECTRICAL LEGEND AND SYMBOLS
 BE0.2 LIGHTING SCHEDULE AND WIRING DIAGRAMS
 BE2.1 FIRST FLOOR POWER PLAN
 BE2.2 SECOND FLOOR POWER PLAN
 BE2.3 FIRST FLOOR LIGHTING PLAN
 BE2.4 SECOND FLOOR LIGHTING PLAN
 BE2.5 FIRST FLOOR MECHANICAL POWER PLAN
 BE2.6 SECOND FLOOR MECHANICAL POWER PLAN
 BE2.7 ROOF POWER PLAN
 BE2.8 FIRST FLOOR TELECOMMUNICATION PLAN
 BE2.9 SECOND FLOOR TELECOMMUNICATION PLAN
 BE3.1 SINGLE LINE DIAGRAM AND SCHEDULES
 BE3.2 TELECOMMUNICATION SCHEMATICS
 BE4.1 ELECTRICAL DETAILS
 BE4.2 TELECOMMUNICATION ROOM DETAILS

FIRE PROTECTION

BFP0.1 FIRE PROTECTION LEGEND AND SYMBOLS
 BFP2.1 FIRST FLOOR FIRE ALARM PLAN
 BFP2.2 SECOND FLOOR FIRE ALARM PLAN
 BFP3.1 FIRE ALARM RISER DIAGRAM AND DETAILS

SITE

Drawing No. Title

GENERAL

SDG1.0 TITLE SHEET
 SDG1.1 SURVEY BY FLSI

CIVIL

SDC1.0 DEMOLITION EROSION CONTROL PLAN
 SDC2.0 DIMENSION CONTROL PLAN
 SDC2.1 GRADING AND DRAINAGE PLAN
 SDC2.2 UTILITY PLAN
 SDC3.0 DETAILS

LANDSCAPING

SDL1.1 LANDSCAPE PLAN
 SDL2.1 IRRIGATION PLAN
 SDL3.1 LANDSCAPE & IRRIGATION DETAILS

ELECTRICAL

SDE2.0 ELECTRICAL SITE PLAN
 SDE2.1 TELECOMMUNICATION SITE PLAN

- - - E N D - - -



**MATERIALS
TESTING &
INSPECTION**

Environmental Services

Geotechnical Engineering

Construction Materials Testing

Special Inspections

GEOTECHNICAL ENGINEERING REPORT
of
**VAMC Community Living Center and
Medical Imaging Center
500 West Fort Street
Boise, Idaho**

Prepared for:

**CSHQA
250 South 5th Street
Boise, Idaho 83702**

MTI File Number B110389g



Mr. Dave Davies
CSHQA
250 South 5th Street
Boise, Idaho 83702
(208) 343-4635

**Re: Geotechnical Engineering Report
VAMC Community Living Center and
Medical Imaging Center
500 West Fort Street
Boise, Idaho**

Dear Mr. Davies:

In compliance with your instructions, we have conducted a soils exploration and foundation evaluation for the above referenced development. Fieldwork for this investigation was conducted on 3 May 2011. Data have been analyzed to evaluate pertinent geotechnical conditions. Results of this investigation, together with our recommendations, are to be found in the following report. We have provided three copies for your review and distribution.

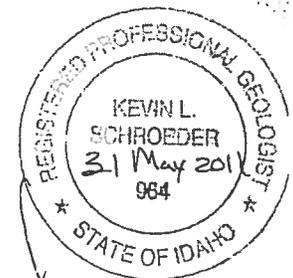
Often questions arise concerning soil conditions because of design and construction details that occur on a project. MTI would be pleased to continue our role as geotechnical engineers during project implementation. Additionally, MTI would be pleased in providing materials testing and special inspection services during construction of this project. If you will advise us of the appropriate time to discuss these engineering services, we will be pleased to meet with you at your convenience.

MTI appreciates this opportunity to be of service to you and looks forward to working with you in the future. If you have questions, please call (208) 376-4748.

Respectfully Submitted,
Materials Testing & Inspection, Inc.

Elizabeth Brown
Elizabeth Brown, E.I.T.
Staff Engineer

Kevin L. Schroeder
Reviewed by: Kevin L. Schroeder, P.G.
Geotechnical Services Manager



David O. Cram
Reviewed by: David O. Cram, P.E.
General Manager

5-31-11



TABLE OF CONTENTS

EXECUTIVE SUMMARY.....	3
INTRODUCTION.....	5
Project Description.....	5
Authorization.....	5
Purpose.....	5
Scope of Investigation.....	6
Warranty and Limiting Conditions.....	6
Limitations.....	6
Exclusive Use.....	6
Report Recommendation are Limited and Subject to Misinterpretation.....	6
Environmental Concerns.....	7
SITE DESCRIPTION.....	7
Site Access.....	7
Regional Geology.....	8
General Site Characteristics.....	8
Regional Site Climatology and Geochemistry.....	8
Geoseismic Setting.....	9
SOILS EXPLORATION.....	9
Exploration and Sampling Procedures.....	9
Laboratory Testing Program.....	9
Soil and Sediment Profile.....	10
Electrical Resistivity, pH, and Water Soluble Sulfate Analysis.....	10
Volatile Organic Scan.....	11
SITE HYDROLOGY.....	11
Groundwater.....	11
Soil Infiltration Rates.....	11
LATERAL EARTH PRESSURES.....	12
Retaining Wall Backfill Materials.....	12
Retaining Wall Drainage.....	13
FOUNDATION, SLAB, AND PAVEMENT DISCUSSION AND RECOMMENDATIONS.....	13
Foundation Design Recommendations.....	14
Floor Slab-on-Grade.....	15
Recommended Pavement Sections.....	15
Flexible Pavement Sections.....	16
Rigid Pavement Sections.....	16
Common Pavement Section Construction Issues.....	17
CONSTRUCTION CONSIDERATIONS.....	18
Earthwork.....	18
Dry Weather.....	19
Wet Weather.....	19
Soft Subgrade Soils.....	19
Frozen Subgrade Soils.....	20
Structural Fill.....	20
Backfill of Walls.....	21
Excavations.....	21
Groundwater Control.....	21
GENERAL COMMENTS.....	22
REFERENCES.....	23
APPENDICES.....	24
Acronym List.....	24
Geotechnical General Notes.....	25
Geotechnical Investigation Boring Log.....	26
Laboratory Test Data.....	31
AASHTO Pavement Thickness Design Procedures.....	32
AASHTO Rigid Pavement Thickness Design Procedures.....	34
Plate 1: Vicinity Map.....	35
Plate 2: Site Map.....	36
Plate 3: Typical Foundation Cross Section.....	37



EXECUTIVE SUMMARY

The following is a brief summary of significant geotechnical issues for the proposed development, presented with conclusions and recommendations. This summary must be read in conjunction with the entire accompanying report for proper interpretation of the overall investigation.

Subsurface Conditions: The profile below represents a generalized interpretation for the project site. Note that on site soils strata, encountered between boring locations, may vary from the individual soil profiles presented in the logs, which can be found in the **Appendix**.

The materials encountered during exploration are quite typical for the geologic area mapped as Sandy Alluvium of Side-Stream Valleys and Gulches. Surficial soils are dark brown to brown, slightly moist to moist, loose to medium dense, fine grained silty sands. Organic materials are often noted to depths of roughly 4 inches.

Underlying surficial silty sands are interbedded layers of poorly graded sand and silty sand. These sediments are most often brown to light brown, exhibit moisture contents of dry to slightly moist, and vary in relative density from loose to medium dense.

Competency of boring walls varied across the site. In general, fine grained soils remain stable while more granular sediments readily sloughed. However, moisture contents will also affect wall competency with wet to saturated soils having a tendency to readily slough when under load and unsupported.

Groundwater Conditions: During this field investigation, groundwater was not encountered in borings advanced to a maximum depth of 21.5 feet bgs. Soil moistures in the borings were generally dry to slightly moist.

In the vicinity of the project site, groundwater levels are controlled in large part by residential and commercial irrigation activity and leakage from nearby canals. Maximum groundwater elevations likely occur during the later portion of the irrigation season. During a previous investigation performed in April 2009 approximately 500 feet to the southeast of the project site, groundwater was noted within a boring at a depth of 30 feet bgs.

Based on evidence of this investigation and background knowledge of the area, MTI estimates groundwater depths greater than approximately 20 feet bgs throughout the year.

Building Foundations: Based on data obtained from the site and test results from various laboratory tests performed, MTI recommends following guidelines for the net allowable soils bearing capacity:



Soil Bearing Capacity

Footings and Structural Slab Depth	ASTM D 1557 Subgrade Compaction	Net Allowable Soil Bearing Capacity
<p>Footings and the structural slab must bear on 3 feet of compacted structural fill¹ reinforced with three layers of Tensar TX 140 Geogrid. Geogrid reinforced fill area should bear on the existing silty sand or poorly graded sand sediments.² The geogrid should be installed in continuous layers at 6, 12, and 18 inches below the footings. A minimum of 18 inches of structural fill must be placed below the bottom layer of geogrid. <u>Geogrid should extend a minimum of 2 feet beyond the footings on all sides.</u> Geogrid should be placed in accordance with the manufacturer's specifications and should be overlapped a minimum distance of 24 inches between rolls. <u>See Plate 3 for graphical representation of this system.</u></p>	<p>95% for Native Soils & Structural Fill</p>	<p>2,500 lbs/ft²</p> <p>A ¹/₃ increase is allowable for short-term loading, which is defined by seismic events or designed wind speeds.</p>

¹Structural fill between geogrid layers must consist of ISPWC ¼" Type I crushed aggregate.

²MTI recommends that a qualified geotechnical engineer or engineering technician verify the bearing soil suitability for each structure at the time of construction. The geogrid reinforced fill material must extend below the existing site grades.

As an alternative a deep foundation system can be considered. Options for a deep foundation system include micropiles or H-piles. If one of these options are desirable, MTI is available to provide design recommendations.

Footings should be proportioned to meet either the stated soil bearing capacity or the 2009 IBC minimum requirements. Total settlement should be limited to approximately 1 inch, and differential settlement should be limited to approximately ½ inch. Objectionable soil types encountered at the bottom of footing excavations should be removed and replaced with structural fill. Excessively loose or soft areas that are encountered in the footing subgrade will require over-excavation and backfilling with structural fill. To minimize the effects of slight differential movement that may occur because of variations in character of supporting soils and seasonal moisture content, MTI recommends continuous footings be suitably reinforced to make them as rigid as possible. For frost protection, the bottom of external footings should be 30 inches below finished grade.

Building Floor Slabs: Organic, loose, or obviously compressive materials must be removed prior to placement of concrete floors or floor-supporting fill. In addition, the remaining subgrade should be treated in accordance with guidelines presented in the **Earthwork** section. Exposed subgrade must be compacted to at least 95 percent of the maximum dry density as determined by ASMT D 1557. Areas of excessive yielding should be excavated and backfilled with structural fill. Fill used to increase the elevation of the floor slab should meet requirements detailed in the **Structural Fill** section. Fill materials must be compacted to a minimum 95 percent of maximum density as determined by ASTM D 1557.



INTRODUCTION

This report presents results of a geotechnical investigation and analysis in support of data utilized in design of structures as defined in the 2009 International Building Code (IBC). Information in support of groundwater and storm water issues pertinent to the practice of Civil Engineering is included. Observations and recommendations relevant to the earthwork phase of the project are also presented. Revisions in plans or drawings for the proposed development from those enumerated in this report should be brought to the attention of the soils engineer to determine whether changes in foundation recommendations are required. Deviations from noted subsurface conditions, if encountered during construction, should also be brought to the attention of the soils engineer.

Project Description

The proposed development is in the northeastern portion of the City of Boise, Ada County, Idaho, and occupies a portion of the SW $\frac{1}{4}$ SW $\frac{1}{4}$ of Section 2, Township 3 North, Range 2 East, Boise Meridian. This project will consist of construction of 2 community living centers (one and two story structures) and 1 one-story medical imaging center. Basements are not being considered, but elevator pit(s) will be included. The area of the proposed construction is currently occupied by Building 13, which will be demolished. The structures are anticipated to be steel frame with metal stud infill. Total settlements are limited to 1 inch. Loads of up to 3,000 pounds per lineal foot for wall footings, and column loads of up to 110 kips were provided to us by CSHQA and were used for settlement calculations. MTI was also informed that in the medical imaging center two, 26,000 pound MRI units will be placed on a reinforced slab-on-grade. Additionally, assumptions have been made for traffic loading of pavements. MTI has not been informed of the proposed grading plan.

Authorization

Authorization to perform this exploration and analysis was given in the form of a written authorization to proceed from Mr. John Maulin of CSHQA to Kevin L. Schroeder of Materials Testing and Inspection, Inc. (MTI), on 17 April 2011. Said authorization is subject to terms, conditions, and limitations described in the Professional Services Contract entered into between CSHQA and MTI. Our scope of services for the proposed development has been provided in our proposal dated 5 January 2011 and repeated below.

Purpose

The purpose of this Geotechnical Engineering Report is to determine various soil profile components and their engineering characteristics for use by either design engineers or architects in:

- Preparing or verifying suitability of foundation design and placement
- Preparing site drainage designs
- Indicating issues pertaining to earthwork construction
- Preparing light and heavy duty flexible and rigid pavement section design requirements



Scope of Investigation

The scope of this investigation included review of geologic literature and existing available geotechnical studies of the area, visual site reconnaissance of the immediate site, subsurface exploration of the site, field and laboratory testing of materials collected, and engineering analysis and evaluation of foundation materials.

Warranty and Limiting Conditions

MTI warrants that findings and conclusions contained herein have been formulated in accordance with generally accepted professional engineering practice in the fields of foundation engineering, soil mechanics, and engineering geology only for the site and project described in this report. These engineering methods have been developed to provide the client with information regarding apparent or potential engineering conditions relating to the site within the scope cited above and are necessarily limited to conditions observed at the time of the site visit and research. Field observations and research reported herein are considered sufficient in detail and scope to form a reasonable basis for the purposes cited above.

Limitations

Six borings were proposed for the project (two borings per building). The presence of underground utilities prohibited one of the borings from being advanced. The boring not advanced was for the southern most building.

Exclusive Use

This report was prepared for exclusive use of the property owner(s), at the time of the report, and their retained design consultants ("Client"). Conclusions and recommendations presented in this report are based on the agreed-upon scope of work outlined in this report together with the Contract for Professional Services between the Client and Materials Testing and Inspection, Inc. ("Consultant"). Use or misuse of this report, or reliance upon findings hereof, by parties other than the Client is at their own risk. Neither Client nor Consultant make representation of warranty to such other parties as to accuracy or completeness of this report or suitability of its use by such other parties for purposes whatsoever, known or unknown, to Client or Consultant. Neither Client nor Consultant shall have liability to indemnify or hold harmless third parties for losses incurred by actual or purported use or misuse of this report. No other warranties are implied or expressed.

Report Recommendation are Limited and Subject to Misinterpretation

There is a distinct possibility that conditions may exist that could not be identified within the scope of the investigation or that were not apparent during our site investigation. Findings of this report are limited to data collected from noted explorations advanced and do not account for unidentified fill zones, unsuitable soil types or conditions, and variability in soil moisture and groundwater conditions. To avoid possible misinterpretations of findings, conclusions, and implications of this report, MTI should be retained to explain the report contents to other design professionals as well as construction professionals.



Since actual subsurface conditions on the site can only be verified by earthwork, note that construction recommendations are based on general assumptions from selective observations and selective field exploratory sampling. Upon commencement of construction, such conditions may be identified that required corrective actions, and these required corrective actions may impact the project budget. Therefore, construction recommendations in this report should be considered preliminary, and MTI should be retained to observe actual subsurface conditions during earthwork construction activities to provide additional construction recommendations as needed.

Since geotechnical reports are subject to misinterpretation, **do not** separate the soil logs from the report. Rather, provide a copy, or authorize for their use, of the complete report to other design professional or contractors.

This report is also limited to information available at the time it was prepared. In the event additional information is provided to MTI following publication of our report, it will be forwarded to the client for evaluation in the form received.

Environmental Concerns

Comments in this report concerning either onsite conditions or observations, including soil appearances and odors, are provided as general information. These comments are not intended to describe, quantify, or evaluate environmental concerns or situations. Since personnel, skills, procedures, standards, and equipment differ, a geotechnical investigation report is not intended to substitute for a geoenvironmental investigation or a Phase II/III Environmental Site Assessment. If the potential for petroleum or hazardous materials contamination or other environmental hazards relating to the site exists, MTI must be informed prior to the commencement of the geotechnical investigation. If environmental services are needed, MTI can provide, via a separate contract, those personnel who are trained to investigate and delineate soil and water contamination.

SITE DESCRIPTION

Site Access

Access to the site may be gained via Interstate 84 to the Broadway Exit. Proceed north on Broadway approximately 3.2 miles to its intersection with Fort Street. From this intersection, proceed west on Fort Street to its intersection with 5th Street. Proceed north on 5th Street to the Veterans Affairs Hospital. The site is located off of VA Hospital Loop at the existing Building 13. Presently the site exists as a vacant structure and landscaped areas. The location is depicted on site map plates included in the **Appendix**.



Regional Geology

The project site is located within the western Snake River Plain of southwestern Idaho and eastern Oregon. The plain is a northwest trending rift basin, about 45 miles wide and 200 miles long, that developed about 14 million years ago (Ma) and has since been occupied sporadically by large inland lakes. Geologic materials found within and along the plain's margins reflect volcanic and fluvial/lacustrine sedimentary processes that have led to an accumulation of approximately 1 to 2 km of interbedded volcanic and sedimentary deposits within the plain. Along the margins of the plain, streams that drained the highlands to the north and south provided coarse to fine-grained sediments eroded from granitic and volcanic rocks, respectively. About 2 million years ago the last of the lakes was drained and since that time fluvial erosion and deposition has dominated the evolution of the landscape. The project site is underlain by "Sandy Alluvium of Side-Stream Valleys and Gulches" as mapped by Othberg and Stanford (1993). Locally, these deposits are composed of medium to coarse sand interbedded with silty fine sand and silt and are mostly derived from weathered granite and reworked Tertiary sediments of the Boise Foothills. The thickness of this unit is variable. Because of the relative youthfulness of these deposits they contain only minor pedogenic clay and calcium carbonate.

General Site Characteristics

This proposed development consists of approximately 1 acre of relatively level previously developed land. Throughout the majority of the site, surficial soils consist of silty sands. Vegetation primarily consists of mature trees, lawn grasses, and landscaping plants.

Regional drainage is south toward the Boise River. Storm water drainage for the site is achieved by percolation through surficial soils. Storm water drainage collection and retention systems are not in place on the project site and do not currently exist within the vicinity of the project site.

Regional Site Climatology and Geochemistry

According to the Western Regional Climate Center (WRCC, 2006) the average precipitation for Treasure Valley is on the order of 10 to 12 inches per year, with an annual snowfall of approximately 20 inches and a range from 3 to 49 inches. The monthly mean daily temperatures range from 21° F to 95° F with daily extremes ranging from -25° F to 111° F. Winds are generally from the northwest or southeast with an annual average wind speed of approximately 9 miles per hour (mph) with a maximum of 62 mph. Soils and sediments in the area are primarily derived from siliceous materials and exhibit low electro-chemical potential for corrosion of metals or concretes. Local aggregates are generally appropriate for Portland cement and lime cement mixtures. Surface waters, groundwaters, and soils in the region typically have pH levels ranging from 7.2 to 8.2 (USGS 2006).



Geoseismic Setting

Soils on site are classed as Site Class E in accordance with Chapter 16 of the 2009 edition of the IBC. Structures constructed on this site should be designed per IBC requirements for such a seismic classification. Our investigation did not reveal hazards resulting from potential earthquake motions including: slope instability, liquefaction, and surface rupture caused by faulting or lateral spreading. Incidence and anticipated acceleration of seismic activity in the area is low. It is noted that liquefaction may occur below the groundwater elevation, based on relatively loose sands encountered in the upper 20 feet across the site. Further investigation and analysis is required to fully assess this potential, and is beyond the scope of this report. It is recommended that at a minimum, site specific geophysical shear-wave measurements be obtained for the site to further assess the liquefaction potential.

SOILS EXPLORATION

Exploration and Sampling Procedures

Field exploration conducted to determine engineering characteristics of subsurface materials included a reconnaissance of the project site and investigation by soil boring. Borings were located in the field by means of visual approximation from on-site features or known locations and are presumed to be accurate to within a few feet. Borings were advanced by means of a truck-mounted drilling rig equipped with a continuous flight hollow-stem augers. At specified depths, samples were obtained using a standard split-spoon sampler, and Standard Penetration Test (SPT) blow counts were recorded. At completion of exploration, borings were backfilled with loose excavated materials, bentonite holeplug, or both.

Samples have been visually classified in the field by professional staff, identified according to boring number and depth, placed in sealed containers, and transported to our laboratory for additional testing. Subsurface materials have been described in detail on logs provided in the **Appendix**. Results of field and laboratory tests are also presented in the **Appendix**. MTI recommends that these logs **not** be used to estimate fill material quantities.

Laboratory Testing Program

Along with our field investigation, a supplemental laboratory testing program was conducted to determine additional pertinent engineering characteristics of subsurface materials necessary in an analysis of the anticipated behavior of the proposed structures. Laboratory tests were conducted in accordance with current applicable American Society for Testing and Materials (ASTM) and American Association of State Highway and Transportation Officials (AASHTO) specifications, and results of these tests are to be found on the accompanying logs located in the **Appendix**. The laboratory testing program for this report included: Atterberg Limits Tests - ASTM D 4318, Grain Size Analysis - ASTM C 117/C 136, Soil Soluble Sulfates – AASHTO T 290, Soil pH – AASHTO T 289, and Soil Resistivity – AASHTO T 288.



Soil and Sediment Profile

The profile below represents a generalized interpretation for the project site. Note that on site soils strata, encountered between boring locations, may vary from the individual soil profiles presented in the logs, which can be found in the **Appendix**.

The materials encountered during exploration are quite typical for the geologic area mapped as Sandy Alluvium of Side-Stream Valleys and Gulches. Surficial soils are dark brown to brown, slightly moist to moist, loose to medium dense, fine grained silty sands. Organic materials are often noted to depths of roughly 4 inches.

Underlying surficial silty sands are interbedded layers of poorly graded sand and silty sand. These sediments are most often brown to light brown, exhibit moisture contents of dry to slightly moist, and vary in relative density from loose to medium dense.

Competency of boring walls varied across the site. In general, fine grained soils remain stable while more granular sediments readily sloughed. However, moisture contents will also affect wall competency with wet to saturated soils having a tendency to readily slough when under load and unsupported.

Electrical Resistivity, pH, and Water Soluble Sulfate Analysis

A grab sample of native poorly graded was collected on 3 May 2011 from a depth ranging from 2.5 to 4.0 feet bgs within the vicinity of boring 2. This location is illustrated on the included site drawing. Analysis results are given in the following table:

Soil Analysis Results

Analysis	Results
Resistivity	6,670 Ohms-cm
pH	8.25
Water Soluble Sulfate Content	<50 ppm

For soils, electrical resistivity is a function of soil chemistry and moisture content. Galvanic currents, which tend to increase the possibility of corrosion, are more likely to develop in low-resistivity soils. The resistivity value obtained is characteristic of soils classified as moderately corrosive to unprotected iron, steel, cast iron, ductile iron, galvanized steel, and dielectric steel or iron. The pH of the sample (8.25) indicates a slightly basic or alkaline soil. A water-soluble sulfate content of <50 ppm was determined and is considered “not applicable” per ACI 318, Table 4.2.1. This investigation is limited in scope and is not intended to represent a comprehensive analysis of corrosivity potential of near-surface native soils. However, based on the evidence of this investigation, “No Type restriction” for cement was indicated for this project, per ACI 318, Table 4.3.1.

MATERIALS TESTING & INSPECTION

31 May 2011
Page # 11 of 37

Envy_mmentat_Servici,S • 0)otechnic 1

rAboise\2011 reports\200-399%1103898\b110389g_geotech.docx
1_Cc nsirliCtiOil Materials restiric; 0 Specitli

Volatile Organic Scan

No environmental concerns were identified prior to commencement of the investigation. Therefore, soils obtained during on-site activities were not assessed for volatile organic compounds by portable photoionization detector.

Samples obtained during our exploration activities exhibited no odors or discoloration typically associated with this type contamination. No groundwater was encountered.

SITE HYDROLOGY

Existing surface drainage conditions are defined in the **General Site Characteristics** section. Information provided in this section is limited to observations made at the time of the investigation. Either regional or local ordinances may require information beyond the scope of this report.

Groundwater

During this field investigation, groundwater was not encountered in borings advanced to a maximum depth of 21.5 feet bgs. Soil moistures in the borings were generally dry to slightly moist.

In the vicinity of the project site, groundwater levels are controlled in large part by residential and commercial irrigation activity and leakage from nearby canals. Maximum groundwater elevations likely occur during the later portion of the irrigation season. During a previous investigation performed in April 2009 approximately 500 feet to the southeast of the project site, groundwater was noted within a boring at a depth of 30 feet bgs.

Based on evidence of this investigation and background knowledge of the area, MTI estimates groundwater depths greater than approximately 20 feet bgs throughout the year.

Soil Infiltration Rates

Soil permeability, which is a measure of the ability of a soil to transmit a fluid, was tested in the field for the poorly graded sands. An estimation of infiltration is presented using generally recognized values for each soil type and gradation. Of soils comprising the generalized soil profile for this study, silty sand soils usually display rates of 4 to 8 inches per hour. Poorly graded sand sediments typically exhibit infiltration values in excess of 12 inches per hour. Infiltration testing is generally not required within these sediments because of their free-draining nature. However, water was added to the bottom of boring 5 and readily infiltrated. Therefore, infiltration testing as specified in the City of Boise Storm Water Management Design Manual was not conducted.

It is recommended that infiltration facilities constructed on the site be extended into native poorly graded sand sediments. Excavation depths of approximately 2 to 7 feet bgs should be anticipated to expose these poorly graded sand sediments. Because of the high soil permeability, ASTM C 33 filter sand, or equivalent, should be incorporated into design of infiltration facilities. An infiltration rate of 8 inches per hour should be used in design.

MATERIALS TESTING & 11611* INSPECTION

31 May 2011
Page # 12 of 37

□ Environow,ntai Services 0 C.:eotec.Hlical Engineering r \boise\2011 reports\200-399%1103890110389g_geotech.docx
J CCir,SVIJCii0r1 MMnfials Testing 0 Spedal Iruipaclions

LATERAL EARTH PRESSURES

Retaining or below-grade walls will be subject to lateral earth pressures. The magnitude of earth pressure is a function of both type and compaction of backfill behind walls within the "active" zone, and allowable rotation of the top of the wall. The active zone is defined as the wedge of soil between the surface of the wall and a plane inclined 29 degrees from vertical passing through the base of the wall. The following recommendations should be used when dealing with lateral earth pressures on a gravity block: 1) a sliding frictional coefficient of 0.40 is appropriate considering native SM/SP soils, and 2) a sliding frictional coefficient of 0.45 is appropriate considering granular structural fill (SP/GP) under typical conditions.

A state of plastic equilibrium is when the subject material is considered to be 1) homogeneous and unbounded and 2) at the point of incipient instability. This state is evaluated on the basis of unit weight, mechanical properties, and the definition of instability. For the purpose of this report, it is assumed that native relatively free draining soils and imported granular fill material will be the materials of concern regarding lateral earth pressures. If other materials are considered for use, MTI must be contacted to provide revised lateral pressure information. Furthermore, changes in natural soil moisture, such as can be imposed by site storm water systems, can change the values listed below.

Below-grade restrained walls should be designed based on at-rest pressures. Active pressures are appropriate under conditions where the wall moves or rotates away from the soil mass at failure. Passive pressures are used for conditions where the wall moves toward the soil mass at failure. Rotation, or lateral movement, of the top of the wall equal to 0.004 times the height of the wall will be necessary for on-site soil backfill to achieve an "active" loading condition. Lateral movement of the top of the wall equal to 0.001 times the height of the wall will be necessary for the "active" pressure condition for imported and compacted SP/GP structural backfill.

Retaining Wall Backfill Materials

For lateral earth pressure analysis, MTI anticipates that the soils of interest will be the native silty sand/poorly graded sand (SM/SP) soils encountered between 0 and 21.5 feet bgs in the borings. For these soils, the following values are applicable under non-surcharged, drained conditions:

Soil Type: Silty Sand/Poorly Graded Sand			
Internal Friction Angle:	32 °	Dry Unit Weight:	120 pcf
Cohesion:	NA	Bouyant Unit Weight:	78 pcf
Natural Void Ratio:	0.5	Natural Moisture:	17 %
At rest lateral earth pressure:	66 psf	$K_o=$	0.5
Active lateral earth pressure:	43 psf	$K_a=$	0.3
Passive lateral earth pressure:	457 psf	$K_p=$	3.3

Lateral Earth Pressure Values for Native Soil

Imported, compacted, structural material, which is used to backfill the soil side of walls, must demonstrate following characteristics:

2791 South Victory View Way • Boise, ID 83709 • (208) 376-4748 • Fax (208) 322-6515
mti@mti-id.com • www.mti-id.com





Lateral Earth Pressure Values for Fill Materials

Soil Type: Compacted Sandy Gravel			
Internal Friction Angle:	35 °	Dry Unit Weight:	128 pcf
Cohesion:	NA	Bouyant Unit Weight:	83 pcf
Natural Void Ratio:	0.4	Natural Moisture:	5 %
At rest lateral earth pressure:	57 psf		$K_o = 0.4$
Active lateral earth pressure:	36 psf		$K_a = 0.3$
Passive lateral earth pressure:	496 psf		$K_p = 3.7$

In the case that another material is used for backfill, MTI should be consulted for correct lateral earth pressure values. Granular structural fill should consist of 4-inch-minus select, clean, granular soil with no more than 30 percent oversize (greater than 1/4-inch) material and no more than 5 percent fines (passing the No. 200 sieve). Retaining wall and basement backfill must be placed in accordance with recommendations in the **Structural Fill** section of this report and must be properly compacted and tested.

Lateral earth pressure values do not incorporate specific factors of safety, and are only applicable for non-surcharged, drained conditions. Factors of safety, if applicable, should be integrated into the structural design of the wall. The preceding values are presented for idealized conditions relating to simple shallow structures. For complex structures, deep structures, or structures with significant perimeter landscaping, a soils engineer should be retained as part of the design team in developing appropriate project design parameters and construction specifications.

Retaining Wall Drainage

MTI recommends that a drainage system be incorporated into the retained soil mass. This can be accomplished by installing wall and toe drains as a part of each soil-supporting wall system. In areas where there is potential for significantly high soil moistures within the supported soil mass, installation of drains within the soil mass is recommended. Particular consideration of roof drain effluent and irrigation water must be made. Further, these drainage systems must be separate from other retaining wall/foundation systems. If the granular structural fill option to reduce lateral pressures is used, a compacted low permeability soil cap is recommended within the upper 2 feet of the surface to limit surface water infiltration behind the walls.

FOUNDATION, SLAB, AND PAVEMENT DISCUSSION AND RECOMMENDATIONS

Various foundation types have been considered for support of the proposed structures. Two requirements must be met in the design of foundations. First, the applied bearing stress must be less than the ultimate bearing capacity of foundation soils to maintain stability. Second, total and differential settlement must not exceed an amount that will produce an adverse behavior of the superstructure. Allowable settlement is usually exceeded before bearing capacity considerations become important; thus, allowable bearing pressure is normally controlled by settlement considerations.



Considering subsurface conditions and the proposed construction, it is recommended that the structure be founded upon conventional spread footings and continuous wall footings in conjunction with bearing on engineered fill reinforced with Tensar geogrid to distribute the load and reduce the magnitude of total and potential differential movement. A maximum footing width of up to 9 feet was used in our settlement analysis. Total settlements should not exceed 1 inch if the following design and construction recommendations are observed.

Similar in concept to a concrete raft foundation, the grid-soil structure distributes loads more broadly and uniformly over the underlying compressible soils. A composite system of geogrid and engineered gravel fill interacts to create a stiffened platform over the loose sands below. Under this approach, a portion of the existing sandy soils are removed within a zone immediately below footings where stress concentrations are highest and replaced with engineered gravel fill. Three layers of Tensar TX 140 Geogrid (or equivalent) would be placed within the fill layers beneath footings. The upper layer of grid should be installed 6 inches beneath the footing, the middle layer at 12 inches below the footing, and the bottom layer 18 inches below the footing with 18 inches of fill material below the bottom layer of geogrid.

Foundation Design Recommendations

Based on data obtained from the site and test results from various laboratory tests performed, MTI recommends following guidelines for the net allowable soils bearing capacity:

Soil Bearing Ca aci

Footing and Structural Slab Depth	ASTM D 1557 Subgrade Compaction	Net Allowable Soil Bearing Capacity
Footings and the structural slab must bear on 3 feet of compacted structural fill' reinforced with three layers of Tensar TX 140 Geogrid. Geogrid reinforced fill area should bear on the existing silty sand or poorly graded sand sediments. ² The geogrid should be installed in continuous layers at 6, 12, and 18 inches below the footings. A minimum of 18 inches of structural fill must be placed below the bottom layer of geogrid. Geogrid should extend a minimum of 2 feet beyond the footings on all sides. Geogrid should be placed in accordance with the manufacturer's specifications and should be overlapped a minimum distance of 24 inches between rolls. See Plate 3 for graphical representation of this system.	95% for Native Soils & Structural Fill	2,500 lbs/ft ² A ¹ / ₃ increase is allowable for short-term loading, which is defined by seismic events or designed wind speeds.

¹Structural fill between geogrid layers must consist of ISPWC 3/4" Type 1 crushed aggregate.

²MTI recommends that a qualified geotechnical engineer or engineering technician verify the bearing soil suitability for each structure at the time of construction. The geogrid reinforced fill material must extend below the existing site grades.

MATERIALS TESTING & *OW/ INSPECTION

31 May 2011
Page # 15 of 37

r: \boise011 reports \200-399 b110389&110389g_geotech.docx
Environmental Servir.:!D5 0 Engineer Ing

J Corisir ucl ion

Materials Testing

0 Specifications

As an alternative a deep foundation system can be considered. Options for a deep foundation system include micropiles or H-piles. If one of these options are desirable, MTI is available to provide design recommendations.

Footings should be proportioned to meet either the stated soil bearing capacity or the 2009 IBC minimum requirements. Total settlement should be limited to approximately 1 inch, and differential settlement should be limited to approximately 1/4 inch. Objectionable soil types encountered at the bottom of footing excavations should be removed and replaced with structural fill. Excessively loose or soft areas that are encountered in the footing subgrade will require over-excavation and backfilling with structural fill. To minimize the effects of slight differential movement that may occur because of variations in character of supporting soils and seasonal moisture content, MTI recommends continuous footings be suitably reinforced to make them as rigid as possible. For frost protection, the bottom of external footings should be 30 inches below finished grade.

Floor Slab-on-Grade

Organic, loose, or obviously compressive materials must be removed prior to placement of concrete floors or floor-supporting fill. In addition, the remaining subgrade should be treated in accordance with guidelines presented in the **Earthwork** section. Exposed subgrade must be compacted to at least 95 percent of the maximum dry density as determined by ASMT D 1557. Areas of excessive yielding should be excavated and backfilled with structural fill. Fill used to increase the elevation of the floor slab should meet requirements detailed in the **Structural Fill** section. Fill materials must be compacted to a minimum 95 percent of maximum density as determined by ASTM D 1557.

A free-draining granular mat (drainage fill course) should be provided below slabs-on-grade. This should be a minimum of 12 inches in thickness and properly compacted. The mat should consist of a sand and gravel mixture, complying with Idaho Standards for Public Works Construction (ISPWC) specifications for 3/4-inch (Type 1) crushed aggregate. A moisture-retarder should be placed beneath floor slabs to minimize potential ground moisture effects on moisture-sensitive floor coverings. The moisture-retarder should be at least 15-mil in thickness and have a permeance of less than 0.3 US perms as determined by ASTM E 96. Placement of the moisture-retarder will require special consideration with regard to effects on the slab-on-grade. The granular mat should be compacted to no less than 95 percent of maximum density as determined by ASTM D 1557. Upon request, MTI can provide further consultation regarding installation.

Recommended Pavement Sections

MTI has made assumptions for traffic loading variables based on the character of the proposed construction. The client should review these assumptions to make sure they reflect intended use and loading of pavements both now and in the future. Based on experience with soils in the region, a subgrade California Bearing Ratio (CBR) value of 5 has been assumed for near-surface soils on site. The following are minimum thickness requirements for assured pavement function. Depending on site conditions, additional work, e.g. soil preparation, may be required to support construction equipment. These have been listed within the **Soft Subgrade Soils** subsection.



Flexible Pavement Sections

The AASHTO design method has been used to calculate the following pavement sections. Calculation sheets provided in the **Appendix** indicate the soils constant, traffic loading, traffic projections, and material constants used to calculate the pavement sections. MTI recommends that materials used in the construction of asphaltic concrete pavements meet requirements of the State of Idaho Transportation Department (ITD) Standard Specification for Highway Construction. Construction of the pavement section should be in accordance with these specifications and should adhere to guidelines recommended in the section on **Construction Considerations**.

AASHTO Flexible Pavement Specifications

*Pavement Section Component	Driveways and Parking No Truck Access	Driveways and Parking Truck Access
Asphaltic Concrete	2.5 Inches	3.0 Inches
Crushed Aggregate Base	8.0 Inches	4.0 Inches
Structural Subbase	6.0 Inches	12.0 Inches
Compacted Subgrade	12.0 Inches	12.0 Inches

*MTI recommends that a qualified geotechnical engineer or engineering technician verify subgrade competency at the time of construction.

- Asphaltic Concrete: Asphalt mix design shall meet the requirements of ITD Class III plant mix. Materials shall be placed in accordance with ITD Standard Specifications for Highway Construction.
- Aggregate Base: Material complying with ITD Standard Specifications for Highway Construction sections 303 and 703 for aggregates.
- Structural Subbase: Material should comply with the requirements detailed in the **Structural Fill** section of this report except that the maximum material diameter is no more than $\frac{2}{3}$ the component thickness.

Rigid Pavement Sections

AASHTO pavement design method was used to develop the following rigid concrete pavement sections. Traffic loading and subgrade values indicated in the flexible pavement design were used in developing the rigid sections. This design method assumes the use of dowels at transverse joints. Concrete pavement shall be batched and constructed in accordance with the most current American Concrete Institute Standards and in accordance with Idaho Transportation Department Standard Drawings C-1-A and C-1-B. Native subgrade soils on the site are frost susceptible, and therefore, require joint sealers or under-drains.



Rigid Pavement Specifications

*Pavement Section Component	Heavy Duty Truck Access
Portland Cement Concrete	8.0 Inches
Crushed Aggregate Base	6.0 Inches
Structural Subbase	0.0 Inches
Compacted Subgrade	12.0 Inches

*MTI recommends that a qualified geotechnical engineer or engineering technician verify subgrade competency at the time of construction.

- Portland Cement Concrete: 4,000 psi concrete with a modulus of rupture greater than 600 psi generally complying with ITD requirement for Urban Concrete.
- Crushed Aggregate Base: Material complying with ITD Standard Specifications for Highway Construction sections 303 and 703 for aggregates.
- Structural Subbase: Material complying with the requirements detailed in the **Structural Fill** section except that the maximum material diameter is no more than $\frac{2}{3}$ the component thickness.

Common Pavement Section Construction Issues

The subgrade upon which above pavement sections are to be constructed must be properly stripped, compacted (if indicated), inspected, and proof-rolled. Proof rolling of subgrade soils should be accomplished using a heavy rubber-tired, fully loaded, tandem-axle dump truck or equivalent. Verification of subgrade competence by a qualified geotechnical engineer or engineering technician at the time of construction is recommended. Fill materials on the site must demonstrate the indicated compaction prior to placing material in support of the pavement section. MTI anticipates that pavement areas will be subjected to moderate traffic. MTI does not anticipate pumping material to become evident during compaction, but subgrade silts near and above optimum moisture contents may tend to pump. Pumping or soft areas must be removed and replaced with structural fill.

Fill material and aggregates as well as compacted native subgrade soils in support of the pavement section must be compacted to no less than 95 percent of the maximum dry density as determined by ASTM D 698 for flexible pavements and by ASTM D 1557 for rigid pavements. If a material placed as a pavement section component cannot be tested by usual compaction testing methods, then compaction of that material must be approved by observed proof rolling. Minor deflections from proof rolling for flexible pavements are allowable. Deflections from proof rolling of rigid pavement support courses should not be visually detectable.

MATERIALS

eTESTING & INSPECTION

31 May 2011
Page # 18 of 37

0 Environmental Services 0 geotechnical Eric4ineei rAboise\2011 reports\200-399\b1103890\110389g_ geotech.docx
Materials Tieting 0 Special inspections

MTI recommends that rigid concrete pavement be provided for heavy garbage receptacles. This will eliminate damage caused by the considerable loading transferred through the small steel wheels onto asphaltic concrete. Rigid concrete pavement should consist of Portland Cement Concrete Pavement (PCCP) generally adhering to ITD specifications for Urban Concrete. PCCP should be 6 inches thick on a 4-inch drainage fill course (see **Floor Slab-on-Grade** section), and should be reinforced with welded wire fabric. Control joints must be on 12-foot centers or less.

CONSTRUCTION CONSIDERATIONS

Recommendations in this report are based upon structural elements of the project being founded on re-compacted native silty sands. Structural areas should be stripped to an elevation that exposes these soil types.

Earthwork

Excessively organic soils, deleterious materials, or disturbed soils generally undergo high volume changes when subjected to loads, which is detrimental to subgrade behavior in the area of pavements, floor slabs, structural fills, and foundations. Mature trees, lawn grasses, and landscape plants with associated root systems were noted at the time of our investigation. It is recommended that organic or disturbed soils, if encountered, be removed to depths of 1 foot (minimum), and wasted or stockpiled for later use. Stripping depths should be adjusted in the field to assure that the entire root zone or disturbed zone or topsoil are removed prior to placement and compaction of structural fill materials. Exact removal depths should be determined during grading operations by a qualified geotechnical representative, and should be based upon subgrade soil type, composition, and firmness or soil stability. If underground storage tanks (USTs), underground utilities, wells, or septic systems are discovered during construction activities, they must be decommissioned then removed or abandoned in accordance with governing Federal, State, and local agencies. Excavations developed as the result of such removal must be backfilled with structural fill materials as defined in the **Structural Fill** section.

MTI should oversee subgrade conditions (i.e., moisture content) as well as placement and compaction of new fill (if required) after native soils are excavated to design grade. Recommendations for structural fill presented in this report can be used to minimize volume changes and differential settlements that are detrimental to the behavior of footings, pavements, and floor slabs. Sufficient density tests should be performed to properly monitor compaction. For structural fill beneath building structures, one in-place density test per lift for every 5,000 square feet is recommended. In parking and driveway areas, this can be decreased to one test per lift for every 10,000 square feet.

MATERIALS TESTING & INSPECTION

31 May 2011
Page # 19 of 37

□ Environmental Services
Serial: 3 enarline

r:\boise\2011 reports\200-399\b 1103898\b I 10389g_geotech.docx
□ Cited wical 0 Construction fvlaturfais TqsUng0

Dry Weather

If construction is to be conducted during dry seasonal conditions, many problems associated with soft soils may be avoided. However, some rutting of subgrade soils may be induced by shallow groundwater conditions related to springtime runoff or irrigation activities during late summer through early fall. Solutions to problems associated with soft subgrade soils are outlined in the **Soft Subgrade Soils** section. Problems may also arise because of lack of moisture in native and fill soils at time of placement. This will require the addition of water to achieve near-optimum moisture levels. Low-cohesion soils exposed in excavations may become friable, increasing chances of sloughing or caving. Measures to control excessive dust should be considered as part of the overall health and safety management plan.

Wet Weather

If construction is to be conducted during wet seasonal conditions (commonly from mid-November through May), problems associated with soft soils must be considered as part of the construction plan. During this time of year, fine-grained soils such as silts and clays will become unstable with increased moisture content, and eventually deform or rut. Additionally, constant low temperatures reduce the possibility of drying soils to near optimum conditions.

Soft Subgrade Soils

Shallow fine-grained subgrade soils that are high in moisture content should be expected to pump and rut under construction traffic. During periods of wet weather, construction may become very difficult if not impossible. The following recommendations and options have been included for dealing with soft subgrade conditions:

- Track-mounted vehicles should be used to strip the subgrade of root matter and other deleterious debris. Heavy rubber-tired equipment should be prohibited from operating directly on the native subgrade and areas in which structural fill materials have been placed. Construction traffic should be restricted to designated roadways that do not cross, or cross on a limited basis, proposed roadway or parking areas.
- Construction roadways on soft subgrade soils should consist of a minimum 2-foot thickness of large cobbles of 4 to 6 inches in diameter with sufficient sand and fines to fill voids. Construction entrances should consist of a 6-inch thickness of clean, 2-inch minimum, angular drain-rock and must be a minimum of **10** feet wide and 30 to 50 feet long. During the construction process, top dressing of the entrance may be required for maintenance.
- Scarification and aeration of subgrade soils can be employed to reduce the moisture content of wet subgrade soils. After stripping is complete, the exposed subgrade should be ripped or disked to a depth of _____ feet and allowed to air dry for 2 to 4 weeks. Further diskings should be performed on a weekly basis to aid the aeration process.
- Alternative soil stabilization methods include use of geotextiles, lime, and cement stabilization. MTI is available to provide recommendations and guidelines at your request.



Frozen Subgrade Soils

Prior to placement of structural fill materials or foundation elements, frozen subgrade soils must either be allowed to thaw or be stripped to depths that expose non-frozen soils and wasted or stockpiled for later use. Stockpiled materials must be allowed to thaw and return to near-optimal conditions prior to use as structural fill.

Structural Fill

Soils recommended for use as structural fill are those classified as GW, GP, SW, and SP in accordance with the Unified Soil Classification System (USCS) (ASTM D 2487). Use of silty soils (USCS designation of GM, SM, and ML) as structural fill may be acceptable. However, use of silty soils (GM, SM, and ML) as structural fill below footings is prohibited. These materials require very high moisture contents for compaction and require a long time to dry out if natural moisture contents are too high and may also be susceptible to frost heave under certain conditions. Therefore these materials can be quite difficult to work with as moisture content, lift thickness, and compactive effort becomes difficult to control. If silty soil is used for structural fill, lift thicknesses should not exceed 6 inches (loose), and fill material moisture must be closely monitored at both the working elevation and the elevations of materials already placed. Following placement, silty soils must be protected from degradation resulting from construction traffic or subsequent construction.

Recommended granular structural fill materials, those classified as GW, GP, SW, and SP, should consist of a 6-inch minus select, clean, granular soil with no more than 50 percent oversize (greater than ¾-inch) material and no more than 12 percent fines (passing No. 200 sieve). These fill materials should be placed in layers not to exceed 12 inches in loose thickness. Prior to placement of structural fill materials, surfaces must be prepared as outlined in the **Construction Considerations** section. Structural fill material should be moisture-conditioned to achieve optimum moisture content prior to compaction. For structural fill below footings, areas of compacted backfill must extend outside the perimeter of the footing for a distance equal to the thickness of fill between the bottom of foundation and underlying soils, or 5 feet, whichever is less.

Each layer of structural fill must be compacted, as outlined below:

- Below Structures and Rigid Pavements: A minimum of 95 percent of the maximum dry density as determined by ASTM D 1557.
- Below Flexible Pavements: A minimum of 92 percent of the maximum dry density as determined by ASTM D 1557 or 95 percent of the maximum dry density as determined by ASTM D 698.

The ASTM D 1557 test method must be used for samples containing up to 40 percent oversize (greater than ¾-inch) particles. If material contains more than 40 percent but less than 50 percent oversize particles, compaction of fill must be confirmed by proof rolling each lift with a 10-ton vibratory roller (or equivalent) until the maximum density has been achieved. Density testing must be performed after each proof rolling pass until the in-place density test results indicate a drop (or no increase) in the dry density, defined as the maximum density or "break over" point. The number of required passes should be used as the requirement on the remainder of fill placement. Material should contain sufficient fines to fill void spaces, and must not contain more than 50 percent oversize particles.

MATERIALS TESTING & INSPECTION

31 May 2011
Page # 21 of 37

□ Environmental Services

□ Geotechnical Engineering

r:\boise\2011 reports \200-399 b II 0389g\ b II 0389g_geotech.docx

Backfill of Walls

Backfill materials must conform to the requirements of structural fill, as defined in this report. For wall heights greater than 2.5 feet, the maximum material size should not exceed 4 inches in diameter. Placing oversized material against rigid surfaces interferes with proper compaction, and can induce excessive point loads on walls. Backfill shall not commence until the wall has gained sufficient strength to resist placement and compaction forces. Further, retaining walls above 2.5 feet in height shall be backfilled in a manner that will limit the potential for damage from compaction methods and/or equipment. It is recommended that only small hand-operated compaction equipment be used for compaction of backfill within a horizontal distance equal to the height of the wall, measured from the back face of the wall.

Backfill should be compacted in accordance with the specifications for structural fill, except in those areas where it is determined that future settlement is not a concern, such as planter areas. In nonstructural areas, backfill must be compacted to a firm and unyielding condition.

Excavations

Shallow excavations that do not exceed 4 feet in depth may be constructed with side slopes approaching vertical. Below this depth, it is recommended that slopes be constructed in accordance with Occupational Safety and Health Administration (OSHA) regulations, section 1926, subpart P. Based on these regulations, on-site soils are classified as type "C" soil, and as such, excavations within these soils should be constructed at a maximum slope of 1 1/2 foot horizontal to 1 foot vertical (1 1/2H:1V) for excavations up to 20 feet in height. Excavations in excess of 20 feet will require additional analysis. Note that these slope angles are considered stable for short-term conditions only, and will not be stable for long-term conditions.

For deep excavations, native granular sediments cannot be expected to remain in position. These materials are prone to failure and may collapse, thereby, undermining upper soils layers. This is especially true when excavations approach depths near the water table. Care must be taken to ensure that excavations are properly backfilled in accordance with procedures outlined in this report.

Groundwater Control

Groundwater was not encountered during the investigation and is anticipated to be below the depth of most construction. However, special precautions may be required for control of surface runoff and subsurface seepage. It is recommended that runoff be directed away from open excavations. Silty soils may become soft and pump if subjected to excessive traffic during time of surface runoff. Ponded water in construction areas should be drained through methods such as trenching, sloping, crowning grades, nightly smooth drum rolling, or installing a French drain system. Additionally, temporary or permanent driveway sections should be constructed if extended wet weather is forecasted.

MATERIALS TESTING (INSPECTION

31 May 2011
Page # 22 of 37

[r:\boise\2011 reports \200-399%110389g\b110389g_geotech.docx](#)
Constructicw esting 0 Spe:ial inspe(nc,rvi

0

GENERAL COMMENTS

When plans and specifications are complete, or if significant changes are made in the character or location of the proposed development, consultation with MTI should be arranged as supplementary recommendations may be required. It is recommended that suitability of subgrade soils and compaction of structural fill materials be verified prior to placement of structural elements. Additionally, monitoring and testing should be performed to verify that suitable materials are used for structural fill and that proper placement and compaction techniques are utilized.



REFERENCES

- American Society for Testing and Materials (ASTM) (1999). Standard Test Method for Materials Finer than 75-um (No. 200) Sieve in Mineral Aggregates by Washing: ASTM C 117 - 95. West Conshohocken, PA: ASTM.
- American Society for Testing and Materials (ASTM) (1999). Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates: ASTM C 136 - 96a. West Conshohocken, PA: ASTM.
- American Society for Testing and Materials (ASTM) (2000). Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort D698-00a. West Conshohocken, PA: ASTM.
- American Society for Testing and Materials (ASTM) (2002). Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort D 1557-02e 1. West Conshohocken, PA: ASTM.
- American Society for Testing and Materials (ASTM) (1999). Standard Test Methods for California Bearing Ratio, ASTM D 1883 86. West Conshohocken, PA: ASTM.
- American Society for Testing and Materials (ASTM) (2006). Standard Practice for Classification of Soils for Engineering Purposes (Unified Soil Classification System) D2487-06. West Conshohocken, PA: ASTM.
- American Society for Testing and Materials (ASTM) (1999). Standard Test Methods for Liquid Limit, Plastic Limit, and Plasticity Index of Soils: ASTM D 4318 - 86. West Conshohocken, PA: ASTM.
- American Society of State Highway and Transportation Officials (AASHTO) (1993). AASHTO Guide for Design of Payment Structures 1993. Washington, D. C.: AASHTO.
- City of Boise. (2007). Storm Water Management Design Manual (August 2007). [Online] Available: http://www.cityofboise.org/public_works/publications/pdf/stwordinance00.pdf (2011).
- Desert Research Institute. Western Regional Climate Center. [Online] Available: <http://www.wrcc.dri.edu/> (2011).
- International Building Code Council (2009). International Building Code, 2009. Country Club Hills, IL: Author.
- Local Highway Technical Assistance Council (LHTAC) (2005). Idaho Standards for Public Works Construction, 2005. Boise, ID: Author.
- Othberg, K. L. and Stanford, L. A., Idaho Geologic Society (1992). Geologic Map of the Boise Valley and Adjoining Area, Western Snake River Plain, Idaho. (scale 1:100,000). Boise, Idaho: Joslyn and Morris.
- State of Idaho, Department of Health and Welfare, Division of Environmental Quality. (April 2000). Technical Guidance Manual For Individual and Subsurface Sewage Disposal Systems. Boise, Idaho: Author.
- U. S. Department of Commerce, National Oceanic and Atmospheric Administration and Desert Research Institute. Western Regional Climate Center. [Online] Available: <http://www.wrcc.dri.edu/> (2011).
- U. S. Dept. of Labor, Occupational Safety and Health Administration. "CFR 29, Part 1926 subpart P: Safety and Health Regulations for Construction, Excavations. (1986)". [Online] Available: www.osha.gov (2011).
- U. S. Geological Survey. (2006). National Water Information System: Web Interface. [Online] Available: <http://waterdata.usgs.gov/nwis> (2011).

APPENDICES

ACRONYM LIST

AASHTO:	American Association of State Highway and Transportation Officials
ACCP:	Asphalt Cement Concrete Pavement
ACRD:	Ada County Highway District
ASTM:	American Society for Testing and Materials
AU:	Auger sample
bgs:	below ground surface
CB:	Carbide bit
CBR:	California Bearing Ratio
D:	natural dry unit weight, pcf
DB:	diamond bit
DM:	Dames & Moore sampling tube
CS:	grab sample
IBC:	International Building Code
ISPWC:	Idaho Standards for Public Works Construction
ITD:	Idaho Transportation Department
LL:	Liquid Limit
M:	water content
MSL:	mean sea level
N:	Standard "N" penetration: blows per foot, Standard Penetration Test
NP:	nonplastic
PCCP:	Portland Cement Concrete Pavement
PERM:	vapor permeability
PI:	Plasticity Index
PID:	photoionization detector
PVC:	polyvinyl chloride
Qc:	cone penetrometer value, unconfined compressive strength, psi
Qp:	Penetrometer value, unconfined compressive strength, tsf
Qu:	Unconfined compressive strength, tsf
SPT:	Standard Penetration Test (140:pound hammer falling 30 in. on a 2:in. split spoon)
SS:	split spoon (13/8:in. inside diameter, 2:in. outside diameter, except where noted)
ST:	shelby tube (3:in. outside diameter, except where noted)
USCS:	Unified Soil Classification System
USDA:	United States Department of Agriculture
UST:	underground storage tank
V:	vane value, ultimate shearing strength, tsf
WT:	apparent groundwater level



GEOTECHNICAL GENERAL NOTES

RELATIVE DENSITY AND CONSISTENCY CLASSIFICATION			
Coarse-Grained Soils	SPT Blow Counts (N)	Fine-Grained Soils	SPT Blow Counts (N)
Very Loose:	< 4	Very Soft:	< 2
Loose:	4-10	Soft:	2-4
Medium Dense:	10-30	Medium Stiff:	4-8
Dense:	30-50	Stiff:	8-15
Very Dense:	>50	Very Stiff:	15-30
		Hard:	>30

Moisture Content	
Description	Field Test
Dry	Absence of moisture, dusty, dry to touch
Moist	Damp but not visible moisture
Wet	Visible free water, usually soil is below water table

Cementation	
Description	Field Test
Weakly	Crumbles or breaks with handling or slight finger pressure
Moderately	Crumbles or breaks with considerable finger pressure
Strongly	Will not crumble or break with finger pressure

PARTICLE SIZE					
Boulders:	>12 in.	Coarse-Grained Sand:	5 to 0.6 mm	Silts:	0.075 to 0.005 mm
Cobbles:	12 to 3 in.	Medium-Grained Sand:	0.6 to 0.2 mm	Clays:	<0.005 mm
Gravel:	3 in. to 5 mm	Fine-Grained Sand:	0.2 to 0.075 mm		

UNIFIED SOIL CLASSIFICATION SYSTEM			
Major Divisions	Symbol	Soil Descriptions	
Coarse-Grained Soils <50% passes No.200 sieve	Gravel & Gravelly Soils <50% coarse fraction passes No.4 sieve	GW	Well-graded gravels; gravel/sand mixtures with little or no fines
		GP	Poorly-graded gravels; gravel/sand mixtures with little or no fines
		GM	Silty gravels; poorly-graded gravel/sand/silt mixtures
	Sand & Sandy Soils >50% coarse fraction passes No.4 sieve	GC	Clayey gravels; poorly-graded gravel/sand/clay mixtures
		SW	Well-graded sands; gravelly sands with little or no fines
		SP	Poorly-graded sands; gravelly sands with little or no fines
SM		Silty sands; poorly-graded sand/gravel/silt mixtures	
Fine Grained Soils >50% passes No.200 sieve	Silts & Clays LL < 50	SC	Clayey sands; poorly-graded sand/gravel/clay mixtures
		ML	Inorganic silts; sandy, gravelly or clayey silts
		CL	Lean clays; inorganic, gravelly, sandy, or silty, low to medium-plasticity clays
	Silts & Clays LL > 50	OL	Organic, low-plasticity clays and silts
		MH	Inorganic, elastic silts; sandy, gravelly or clayey elastic silts
Highly Organic Soils	PT	CH	Fat clays; high-plasticity, inorganic clays
		OH	Organic, medium to high-plasticity clays and silts
			Peat, humus, hydric soils with high organic content



**MATERIALS
TESTING &
INSPECTION**

FIELD BOREHOLE LOG

BOREHOLE NO.: **B-1**
TOTAL DEPTH: **21.5'**

PROJECT INFORMATION

DRILLING INFORMATION

PROJECT: **VA Community Living Center**
LOCATION: **500 West Fort Street**
JOB NO.: **B10389g**
LOGGED BY: **Elizabeth Brown, E.I.T.**

DRILLING CO.: **Haztech Drilling, Inc.**
METHOD OF DRILLING: **6" hollow stem auger**
SAMPLING METHODS: **Split Spoon**
DATES DRILLED: **3 May 2011**



Water level during drilling



Standard Split Spoon



Shelby Tube



California Sampler

DEPTH	SOIL TYPE	SAMPLE	SOIL DESCRIPTION	BLOWS	BLOWS PER FOOT (N)
0			SILTY SAND (SM): Dark brown to brown, moist, loose, fine to medium grained sand. Organic material in the upper 4 inches.	2/3/3	
				2/3/3	
5				3/4/5	0 30 60
			POORLY-GRADED SAND (SP): Light brown, dry, loose, fine to medium grained sand, fine gravel.	5/4/5	
10			SANDY SILT (ML): Brown, slightly moist, medium stiff to stiff, fine grained sand. Lenses of fine to medium grained sand throughout.	4/3/3	0 30 60
15				4/5/5	0 30 60
20			SILTY SAND (SM): Brown, slightly moist, loose to medium dense, fine grained sand. Lenses of fine to medium grained sand throughout.	3/4/6	0 30 60



**MATERIALS
TESTING &
INSPECTION**

FIELD BOREHOLE LOG

BOREHOLE NO.: **B-2**

TOTAL DEPTH: **11.5'**

PROJECT INFORMATION

DRILLING INFORMATION

PROJECT: **VA Community Living Center**
 LOCATION: **500 West Fort Street**
 JOB NO.: **B10389g**
 LOGGED BY: **Elizabeth Brown, E.I.T.**

DRILLING CO.: **Haztech Drilling, Inc.**
 METHOD OF DRILLING: **6" hollow stem auger**
 SAMPLING METHODS: **Split Spoon**
 DATES DRILLED: **3 May 2011**



Water level during drilling



Standard Split Spoon



Shelby Tube



California Sampler

DEPTH	SOIL TYPE	SAMPLE	SOIL DESCRIPTION	BLOWS	BLOWS PER FOOT (N)
0			SILTY SAND (SM): Dark brown, slightly moist, medium dense, fine grained sand. Organic material in upper 4 inches.	1/5/7	
			POORLY-GRADED SAND (SP): Brown, slightly moist, medium dense to dense, fine to medium grained sand, with silt to 5 feet below ground surface (bgs), fine to coarse gravel from 5 to 10 feet bgs.	3/4/7	
5				9/12/17	0 30 60
				12/24/22	
10			SILTY SAND (SM): Brown, slightly moist, loose to medium dense, fine to medium grained sand.	3/4/6	0 30 60



**MATERIALS
TESTING &
INSPECTION**

FIELD BOREHOLE LOG

BOREHOLE NO.: **B-3**
TOTAL DEPTH: **21.5'**

PROJECT INFORMATION

DRILLING INFORMATION

PROJECT: **VA Community Living Center**
LOCATION: **500 West Fort Street**
JOB NO.: **BIO389g**
LOGGED BY: **Elizabeth Brown, E.I.T.**

DRILLING CO.: **Haztech Drilling, Inc.**
METHOD OF DRILLING: **6" hollow stem auger**
SAMPLING METHODS: **Split Spoon**
DATES DRILLED: **3 May 2011**



Water level during drilling



Standard Split Spoon



Shelby Tube



California Sampler

DEPTH	SOIL TYPE	SAMPLE	SOIL DESCRIPTION	BLOWS	BLOWS PER FOOT (N)
0			SILTY SAND (SM): Dark brown, slightly moist, loose, fine grained sand. Organic material in upper 4 inches.	2/3/2	
			POORLY-GRADED SAND (SP): Brown to light brown, slightly moist to dry, loose, fine to medium grained sand.	4/5/4	
5			SILTY SAND (SM): Brown, dlightly moist, loose, fine grained sand.	2/2/4	
			POORLY-GRADED SAND (SP): Brown to light brown, dry, loose, fine to medium grained sand.	2/2/2	
10			SILTY SAND (SM): Brown, slightly moist, loose to medium dense, fine to medium grained sand.	3/8/7	
15				4/6/4	
20			POORLY-GRADED SAND (SP): Light brown, dry, medium dense, fine to medium grained sand, fine gravel.	11/7/8	



**MATERIALS
TESTING &
INSPECTION**

FIELD BOREHOLE LOG

BOREHOLE NO.: **B-4**

TOTAL DEPTH: **11.5'**

PROJECT INFORMATION

PROJECT: **VA Community Living Center**
 LOCATION: **500 West Fort Street**
 JOB NO.: **B10389g**
 LOGGED BY: **Elizabeth Brown, E.I.T.**

DRILLING INFORMATION

DRILLING CO.: **Haztech Drilling, Inc.**
 METHOD OF DRILLING: **6" hollow stem auger**
 SAMPLING METHODS: **Split Spoon**
 DATES DRILLED: **3 May 2011**



Water level during drilling



Standard Split Spoon



Shelby Tube



California Sampler

DEPTH	SOIL TYPE	SAMPLE	SOIL DESCRIPTION	BLOWS	BLOWS PER FOOT (N)
0			SILTY SAND (SM): Dark brown, moist to slightly moist, medium dense, fine grained sand. Organic material in upper 4 inches.	1/4/8	
5			POORLY-GRADED SAND (SP): Light brown, dry, loose to medium dense, fine to medium grained sand, fine gravel, with silt from 9.5 to 11.5 feet bgs.	4/4/2	0 30 0
10				8/9/8	
				6/8/5	0 30 60



**MATERIALS
TESTING &
INSPECTION**

FIELD BOREHOLE LOG

BOREHOLE NO.: **B-5**
TOTAL DEPTH: **21.5'**

PROJECT INFORMATION

PROJECT: **VA Community Living Center**
LOCATION: **500 West Fort Street**
JOB NO.: **B10389g**
LOGGED BY: **Elizabeth Brown, E.I.T.**

DRILLING INFORMATION

DRILLING CO.: **Haztech Drilling, Inc.**
METHOD OF DRILLING: **6" hollow stem auger**
SAMPLING METHODS: **Split Spoon**
DATES DRILLED: **3 May 2011**



Water level during drilling



Standard Split Spoon



Shelby Tube



California Sampler

DEPTH	SOIL TYPE	SAMPLE	SOIL DESCRIPTION	BLOWS	BLOWS PER FOOT (N)
0					
0 - 3			SILTY SAND (SM): Dark brown, slightly moist, loose to medium dense, fine grained sand. Organic material in the upper 3 inches.	2/4/6	
3 - 21.5			POORLY-GRADED SAND (SP): Light brown, dry to slightly moist, loose to medium dense, fine to medium grained sand, with silt from 5.0'-5.3', 7.5'-9.0', 11.1'-11.5', and 20'-20.4'.	4/4/5 4/7/9 5/7/8 6/5/6 7/8/11 4/3/3	



LABORATORY TEST DATA

Lab Test ID	Sample Location	M	LL	PI	Sieve Analysis				
					#4	#10	#40	#100	#200
-	-	%	-	-					
A	B-3 5.0'-6.5'	17.1	NP	NP	96	92	77	51	31.4



AASHTO PAVEMENT THICKNESS DESIGN PROCEDURES

Pavement Section Design Location: VA Community Living Center, No Truck Access				
Average Daily Traffic Count:	200	All Lanes g.z. Both Directions		
Design Life:	20	Years		
Percent of Traffic in Design Lane:	100%			
Terminal Serviceability Index (Pt):	2.5			
Level of Reliability:	95			
Subgrade CBR Value:	5	Subgrade Mr:	7,500	
Calculation of Design-18 kip ESALs				
	Daily Traffic	Growth Rate	Load Factors	Design ESALs
Passenger Cars:	80	2.0%	0.0008	568
Buses:	1	2.0%	0.6806	6,036
Panel & Pickup Trucks:	13	2.0%	0.0122	1,407
2-Axle, 6-Tire Trucks:	5	2.0%	0.1890	8,381
Concrete Trucks:	1.0	2.0%	4.4800	39,731
Dump Trucks:	0	2.0%	3.6300	0
Tractor Semi Trailer Trucks:	0	2.0%	2.3719	0
Double Trailer Trucks:	0	2.0%	2.3187	0
Heavy Tractor Trailer Combo Trucks:	0	2.0%	2.9760	0
Average Daily Traffic in Design Lane:	100			
Total Design Life 18-kip ESALs:	56,122			
Actual Log (ESALs):	4.749			
Trial SN:	2.30			
Trial Log (ESALs):	4.757	This number must be equal to or greater than the Actual Log.		
Pavement Section Design SN:	2.41	This number must be equal to or greater than the Trial SN.		
	Design Depth Inches	Structural Coefficient	Drainage Coefficient	
Asphaltic Concrete:	2.50	0.42	n/a	
Asphalt-Treated Base:	0.00	0.25	n/a	
Cement-Treated Base:	0.00	0.17	n/a	
Crushed Aggregate Base:	4.00	0.14	1.0	
Pit Run Aggregate Subgrade:	8.00	0.10	1.0	
Special Aggregate Subgrade:	0.00	0.09	0.9	

MATERIALS TESTING & INSPECTION

31 May 2011
Page # 33 of 37

0 Environmental Services 0 Geotechnical Engineering rAboise\2011 reports\1200-399\b110389g\b110389g_geotech.docx
0 Construction Materials Testing 0 Special Inspections

AASHTO PAVEMENT THICKNESS DESIGN PROCEDURES

Pavement Section Design Location: VA Community Living Center, Truck Access

Average Daily Traffic Count: 200 All Lanes & Both Directions
Design Life: Percent of Traffic in Design Lane: Terminal 20 Years
Serviceability Index (Pt): Level of Reliability: 100%
 2.5
95
Subgrade CBR Value: 5 **Subgrade Mr:** 7,500

Calculation of Design-18 kip ESALs

	Daily Traffic	Growth Rate	Load Factors	Design ESALs
Passenger Cars:	62	2.0%	0.0008	440
Buses:	5	2.0%	0.6806	30,180
Panel & Pickup Trucks:	15	2.0%	0.0122	1,623
2-Axle, 6-Tire Trucks:	10	2.0%	0.1890	16,762
Concrete Trucks:	1.0	2.0%	4.4800	39,731
Dump Trucks:	1	2.0%	3.6300	32,193
Tractor Semi Trailer Trucks:	4	2.0%	2.3719	84,141
Double Trailer Trucks:	2	2.0%	2.3187	41,127
Heavy Tractor Trailer Combo Trucks:	.0	2.0%	2.9760	0
Average Daily Traffic in Design Lane:	100			

Total Design Life 18-kip ESALs: 246,196

Actual Log (ESALs): 5.391

Trial SN: 2.94

Trial Log (ESALs): 5.398 This number must be equal to or greater than the Actual Log.

Pavement Section Design SN: 3.02 This number must be equal to or greater than the Trial SN.

	Design Depth Inches	Structural Coefficient	Drainage Coefficient
Asphaltic Concrete:	3.00	0.42	n/a
Asphalt-Treated Base:	0.00	0.25	n/a
Cement-Treated Base:	0.00	0.17	n/a
Crushed Aggregate Base:	4.00	0.14	1.0
Pit Run Aggregate Subgrade:	12.00	0.10	1.0
Special Aggregate Subgrade:	0.00	0.09	0.9



AASHTO RIGID PAVEMENT THICKNESS DESIGN PROCEDURES

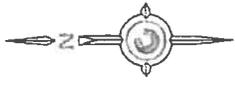
Average Daily Traffic Count:	200 All Lanes & Both Directions			
Design Life: % of Traffic in Design Lane: Terminal	20 Years			
Serviceability Index, Pt: Level of Reliability, R: Subgrade CBR Value: Native Modulus of Subgrade Reaction, K: Effective Modulus of Subgrade Reaction, K: Concrete Elastic Modulus, Ec:	100%	2 (2.5 for major highways, 2.0 for lower traffic volumes)	R-Value: 11	
Transfer Coefficient, J: Drainage Coefficient, Cd: Standard Deviation, So: Design Serviceability Loss, Delta PSI:	5	Subgrade Mr: 7,500		
	130 (select from chart based on CBR Value)			
	160 (modified for base aggregate section, indicate at bottom of sheet)			
	4200000 (typical is 4,200,000 psi)			
	650 (typical is 750 psi)			
	4.2 (see information to the right for selection)			
	I (see Table 520.1.8.1 from Idaho Manual)			
	0.34 (use 0.34 without specific information)			
	2.5 (2.0 for interstates & 2.5 for secondary routes)			
Calculation of Design 18 kip ESALs				
	Daily Traffic	Growth Rate	Load Factors	Design ESAL's
Passenger Cars:	62	2.0%	0.0008	440
Buses:	5	2.0%	0.6806	30,180
Panel & Pickup Trucks:	15	20%	0.0122	1,623
2 Axle, 6 Tire Trucks:	10	2.0%	0.1890	16,762
Concrete Trucks:		2.0%	4.4800	39,731
Dump Trucks:	1	2.0%	3.6300	32,193
Tractor Semi Trailer Trucks:	4	2.0%	2.3719	84,141
Double Trailer Trucks:	2	2.0%	2.3187	41,127
Heavy Tractor Trailer Combo Trucks:	0	2.0%	2.9760	0
Average Daily Traffic in Design Lane:	100			
Total Design Life 18 kip ESAL's:	246,196	Traffic Index equivalent= 7.6		
Actual Log (ESAL's):	5.391			
Trial Pavement Design Thickness, inches:	8.00			
Trial Log (ESAL's):	5.950	This must be equal to or greater than the Actual Log (ESAL's)		
Pavement Design Thickness, Inches:	8.0			
Road Mix Section Thickness, Inches:	6.0			

MAP NOTES:

- Delorme Street Atlas
- Not to Scale

LEGEND

Approximate Site Location



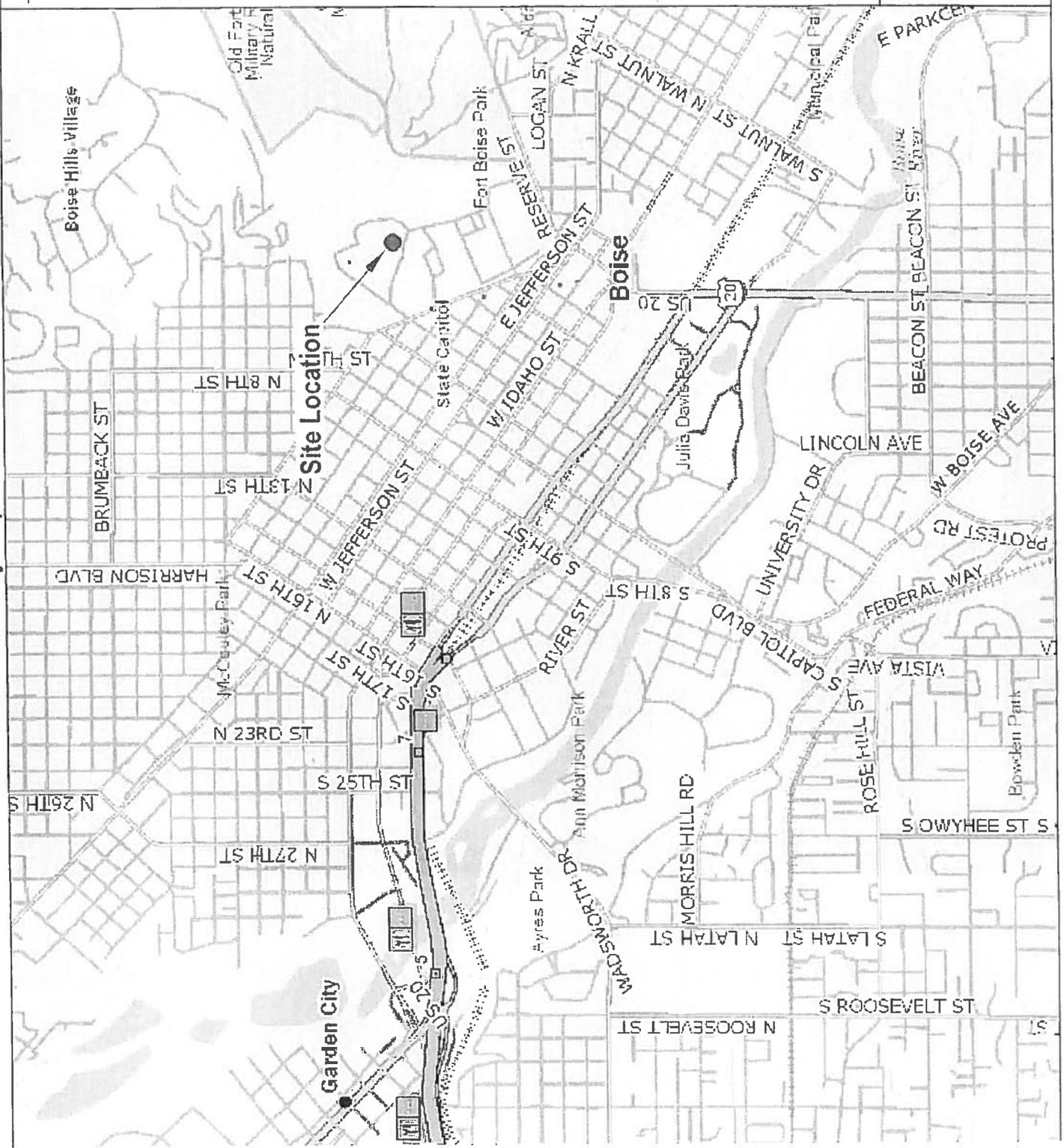
VA Community Living Center
 500 West Fort Street
 Boise, ID

Modified from Delorme by: EB
 23 May 2011
 Drawing: B10398g

MATERIALS TESTING & INSPECTION



2791 S. Victory View Way
 Boise, ID 83709-2835
 Phone: 208 376-4748
 Fax: 208 322-6515
 E-mail: mt@mti-id.com



NOTES:

- Not to Scale

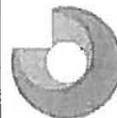
LEGEND

Approximate MTI Boring Location



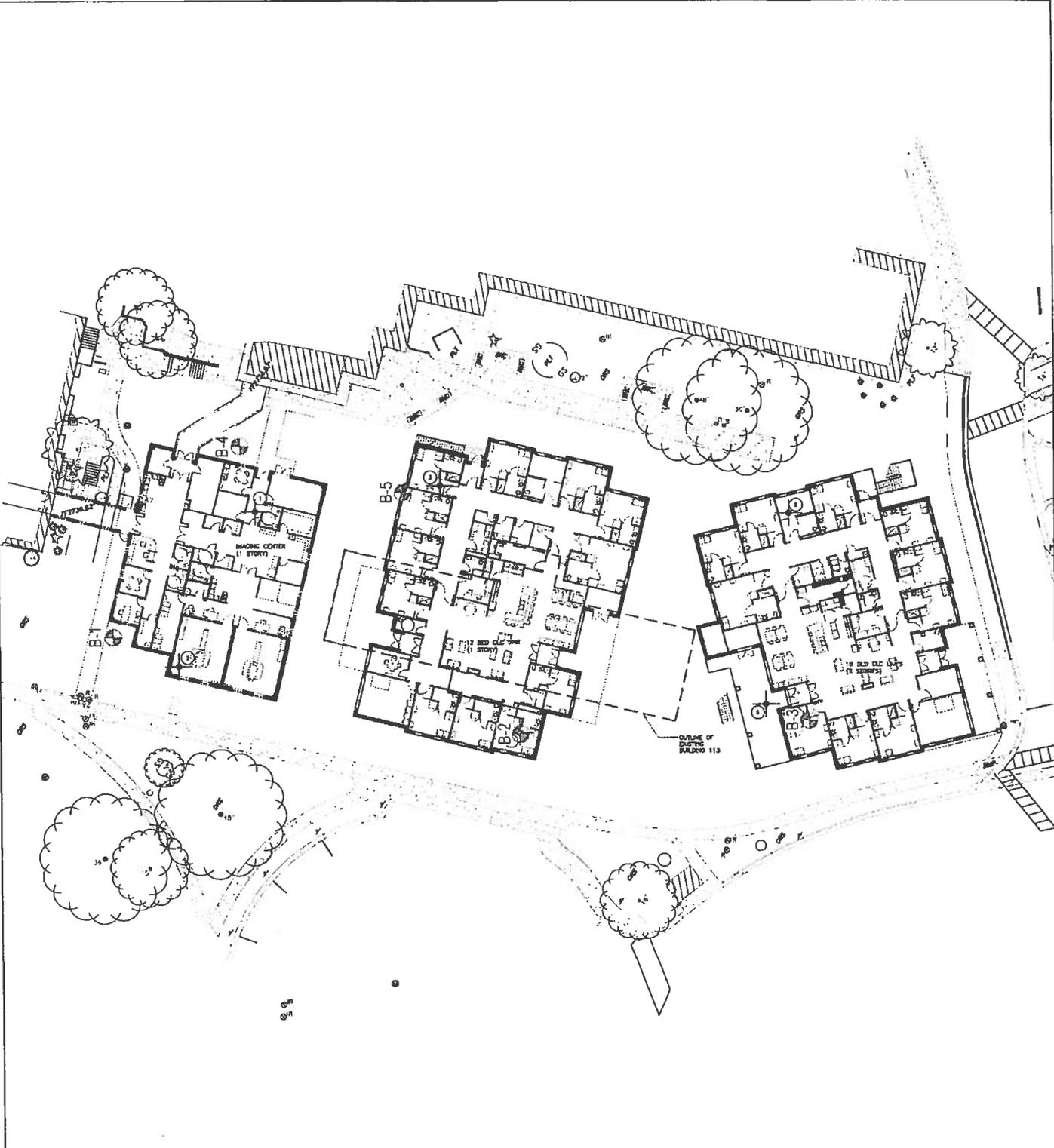
VA Community Living Center
500 West Fort Street
Boise, ID

Modified from CSHQA by: EB
23 May 2011
Drawing: B10389g



**MATERIALS
TESTING &
INSPECTION**

Phone: 208 376-4748
Fax: 208 322-6515
E-mail: mti@mti-id.com

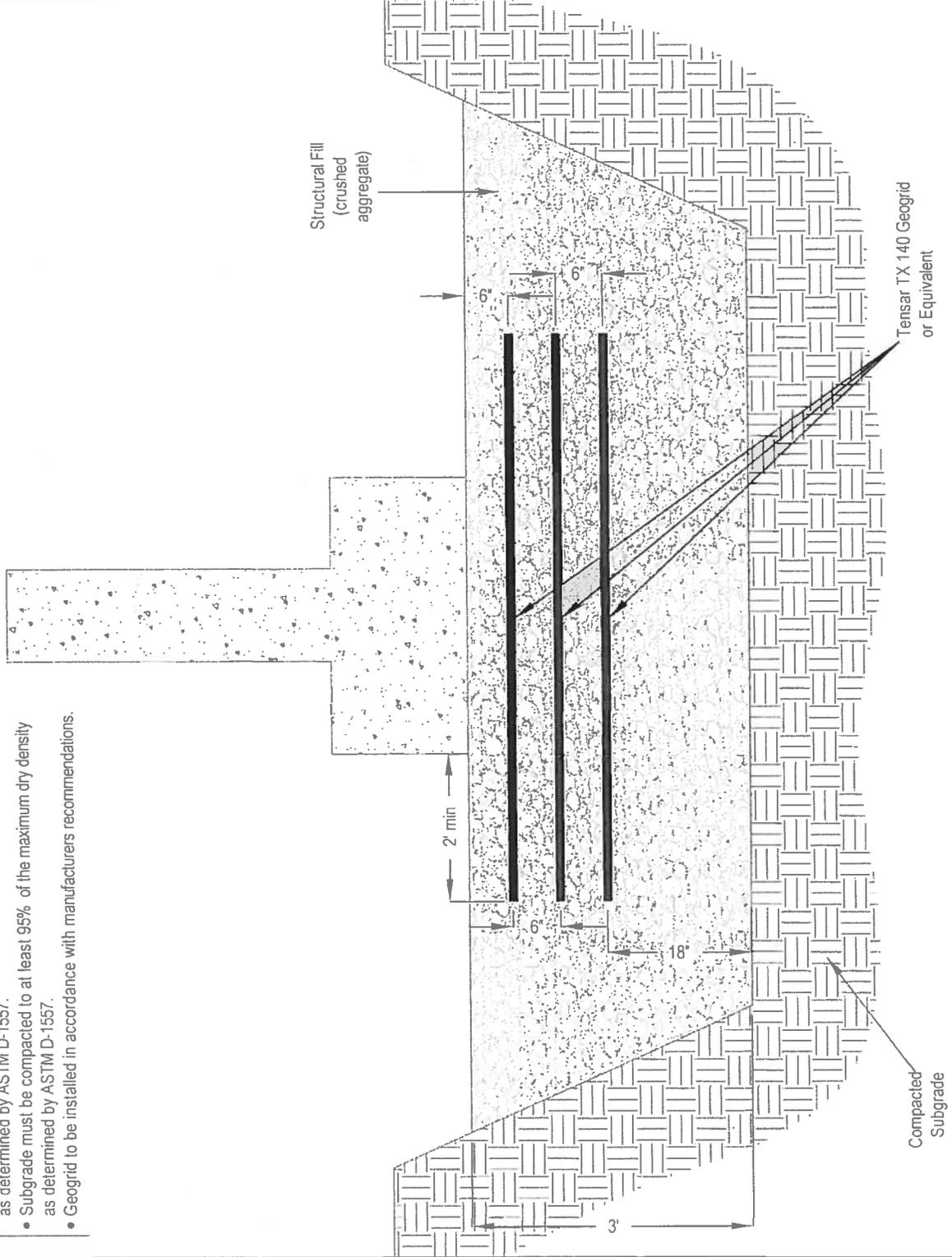


Typical Foundation Cross Section

Plate 3

NOTES:

- Structural fill between geogrid layers must consist of ISPCW 3/4" Type 1 crushed aggregate.
- Fill material must be compacted to at least 95% of the maximum dry density as determined by ASTM D-1557.
- Subgrade must be compacted to at least 95% of the maximum dry density as determined by ASTM D-1557.
- Geogrid to be installed in accordance with manufacturers recommendations.



NOTES:

- Not to Scale

LEGEND

VA Community Living Center
500 West Fort Street
Boise, ID

Drawn by: EB
26 May 2011
Drawing: B10369g



**MATERIALS
TESTING &
INSPECTION**

2791 S. Victory View Way
Boise, ID 83709-2835
Phone: 208.376-4748
Fax: 208.322-6515
E-mail: mt@mti-id.com

SECTION 01 00 00
GENERAL REQUIREMENTS

1.1 GENERAL INTENTION

- A. Contractor shall completely prepare site for building operations, including demolition and removal of existing structures, and furnish labor and materials and perform work to construct new Community Living Center on the Boise VA Medical Center Campus, Project #531-319, Boise, ID as required by Drawings and Specifications. Note that references to the "Medical Center" refer to the Boise VA Medical Center Campus.
- B. Visits to the site by Bidders may be made only by appointment with the COTR, Shawn Flagstad, 208-422-1000 x4405.
- C. Offices of CSHQA, a design collaboration, will render certain technical services during construction. Such services shall be considered as advisory to the Government and shall not be construed as expressing or implying a contractual act of the Government without affirmations by Contracting Officer or his duly authorized representative.
- D. All employees of general contractor and subcontractors shall comply with Veterans Affairs (VA) security management program and obtain permission of the VA police, be identified by project and employer, and restricted from unauthorized access.
- E. Prior to commencing work, general contractor shall provide proof that a OSHA certified "competent person" (CP) (29 CFR 1926.20(b)(2)) will maintain a presence at the work site whenever the general or subcontractors are present.
- F. Training
 - 1. Beginning July 31, 2005, all employees of general contractor or subcontractors shall have the 10-hour OSHA certified Construction Safety course and /or other relevant competency training, as determined by the VA Contracting Officer with input from the Infection Control Risk Assessment (ICRA) team.
 - 2. Submit training records of all such employees for approval before the start of work.
- G. Contractor Medical Program

The Contractor shall have a Medical Program that addresses tuberculosis. The medical program shall include written assurance that each employee has no active tuberculosis. All contract employees assigned to the work site shall have a pre-placement tuberculin screening within 90 days prior to assignment to the worksite as recommended by the Center for Disease Control (CDC). This can be the CDC two-step skin testing or a Food and Drug Administration (FDA) approved blood test. Employees manifesting positive screening reactions to the tuberculin shall be

examined per current CDC guidelines prior to working on VHA property. If the employee is found without evidence of active (infectious) pulmonary tuberculosis (TB), a statement documenting examination by a physician must be on file with the employer (construction contractor), noting that the employee with a positive tuberculin screening test is without evidence of active (infectious) pulmonary TB. If the employee is found with evidence of active (infectious) pulmonary TB, the employee would require treatment with a subsequent statement as outlined above before being allowed to return to work on VHA property.

- H. Terms used in this contract such as Veterans Affairs (VA) and Government; Contracting Officer (CO); Architect-Engineer (AE); Contracting Officer's Technical Representative (COTR) or resident engineer (RE), Engineering Officer (EO) may be used interchangeably, and refer to the same entity.
- I. The project schedule must be received and approved prior to starting on-site work. Since it may require significant time to approve the schedule and coordinate any VA moves, this schedule should be submitted early. Refer to General Conditions 852.236-84, Schedule of Work Progress. The schedule is to contain a minimum a description of each activity, the estimated duration, the trade and crew size, and the planned start and completion dates. It is strongly suggested that the Contractor submit long lead items for approval early in the project to avoid project delays due to untimely submission of submittals.
- J. An updated progress schedule is to be provided prior to the submittal of each request for payment. The updated schedule is to show all activities started and/or completed during the reporting period and a projection of the activities that will take place during the following reporting period.
- K. All contract work in each phase, including final inspection and punch list items impacting unobstructed use of the area(s) of that phase, shall be completed by the Contractor prior to turning over the area(s) to the VA for their 21 calendar day equipment relocation and occupancy. It will be at the discretion of the VA as to which punch list items prevent unobstructed use of the area(s) of a phase. All phases must be completed, including all punch list items, with the overall project period timeframe.
- L. Refer to section 1.43 for Construction Scope of Work.

1.2 PROJECT NARRATIVE

A. General Concept

1. The planning was based on VA directed cultural change related to their current Nursing Home program. This change includes transforming these facilities to Community Living Centers (CLC). At the time of programming, no specific VA guideline had been published to delineate the required criteria for a VA CLC so we discussed the design criteria with feedback from: Christa Hojlo, PhD, Director of the Department of Veterans Affairs (VA) Community Living Centers (formerly VA nursing homes) and State Veterans Homes Clinical and Survey Oversight, to obtain insight into the new VA philosophy regarding these facilities. Additionally, a draft copy of the CLC design guidelines was provided for guidance purposes during programming. During the construction document phase a final copy of the guidelines was provided for coordination for coordination purposes, where the user group felt appropriate.
2. The new CLC design focused on VA's approach to the "Green House" or "Small House" model. Houses are developed in 10 to 12 bed homes eliminating long halls and various unknown people roaming through the building. Assumptions that guided the design are as follows:
 - a. Residential feel and spaces - creation of a home.
 - b. Patient centered.
 - c. Limited access similar to one's own home.
 - d. Comply with NFPA chapter 18 - Nursing Homes.
 - e. Three types of residents: rehabilitation, skilled nursing/long term stay, and hospice - based on the Boise VAMC facility's acuity level and needs.
3. The site for these buildings flanked by Buildings 67 on the north and is located in the location of the existing Building 13 and between the existing main sidewalk and the west face of building 88. A planned Imaging Building is to be constructed between the new CLC and the existing Building 67. The footprint for the Future Imaging Building appears on the site plans for reference purposes. The area is relatively flat with grass and a few large trees. The construction of this scheme will require that portions of the connection walkways be demolished. Removal of building 13 and various concrete walkways is scheduled to occur prior to the start of this project.
4. This project has been designed to include two separate buildings: one single story building with 12 bedrooms (Building "A"), and one two-story building with 10 bedrooms on each floor (Building "B"). Staff access is provided through new entries off both the west and east sides of the new homes and will connect to the main sidewalk running the length of the

main hospital buildings. Resident access is provided primarily off the area between the new homes. A rear exit walkway provides direct access to buildings 67 and 88 and parking areas off to the northeast. A 20 foot separation has been provided to all buildings to allow future fire and utility access between buildings, the new planned imaging building to the west, building 67, and building 85.

5. Due to the relatively tight site area, the buildings have been carefully located to accommodate a number of critical existing site utilities and infrastructure elements such as electrical vaults. As such, it should be noted that specific accommodations have been made to the footing design to avoid interference with these utilities. However, it should be noted that care will still need to be taken to confirm that these utilities and electrical vaults are located as indicated in the site survey, and that they are not disturbed by construction activities during the course of the project. Also of note is the construction of the new drain field in the area directly adjacent to the existing flag pole, which is to remain and be protected. Specific notes for coordination and protection of these and other similar utilities, site improvements and landscaping are included in the construction documents and should be consulted prior to commencing with work on this project.
6. Also of note is the inclusion of a number of Bid Options within this project. These have been included to assist the VA in reviewing and evaluating the bids for this project and allow the VA to obtain the most beneficial scope of work within the available construction budget. Perhaps more importantly, since bidding of the adjacent Imaging project is anticipated to occur at the same time as this project, there are a number of bid options that will need to be evaluated based on the actual timeframe of that project. This will allow the VA to determine which bid options are most appropriate to include with each respective project, and to allow for the most efficient construction of this project.

B. BUILDING DESIGN CONCEPTS

1. The building is organized into a somewhat conventional house plan while supporting the code needs related to a nursing home environment. Major circulation paths and corridors are 8' wide minimum with some open areas, like the dining room and living room, which both share some space with this circulation. The inclusion and location of these open areas helps to promote the feeling of a home versus that of a more institutional facility.

2. Rooms anticipated in each house, as outlined in the space program developed by the Design Committee and included in the construction documents, are as follows:
 - a. Bedroom and bathroom - one for each General Resident. While these rooms are designed to provide a more home like environment, they will also contain certain built in medical equipment to provide for staff and patient safety. This includes: built in patient lifts connecting the bed area to the shower and toilet in the in-suite bathroom, a headwall with oxygen, patient light control and staff call button, and staff call capability from the bathroom. In room staff computing needs will be accommodated with provisions for a wall mounted workstation which can support computer use. Government furnished millwork will be provided for clean and soiled linen storage in the bedroom. Each bathroom will contain a sink, toilet and roll-in shower
 - b. Bedroom and bathroom, Special Care Resident Room - One per House, for residents with bariatric or spinal cord injury care needs and other conditions which require additional space for mobility and equipment clearances. Equipment and furnishings are anticipated to be similar to General Resident bedrooms and bathrooms with accommodations for special needs noted above.
 - c. Home Office - nursing sub-station, and care giver / universal worker work space.
 - d. Medicine Room (Pharmacy) - locked room adjacent to bedrooms for storage of controlled/refrigerated medications, within accudose machine and refrigerator.
 - e. Living Room -area facilitates residential activities such as reading and television watching. This space is focused on a central fireplace and entertainment center, much as in a typical house to reinforce the feeling of a home.
 - f. Den - facilitates quiet residential activities, private family dining and private meeting with residents/staff and outside visitors.
 - g. Activity Alcoves - multi-use space with computer alcoves for internet usage, games, etc.
 - h. Dining Room - facilitates residential dining, sized to allow all residents, caregivers and potential guests to dine in a family style setting, and accommodate various table configurations.
 - i. Kitchen / Servery - provides required space for staging, preparing and serving of food, and clean up activities. Based on discussions with the design committee and facility food service during programming, it is anticipated that prepared food will be delivered

- from a central kitchen, and served / plated within the kitchen / dining room for each resident. Dishes and utensils will be cleaned in house by universal care staff. The kitchen may also be utilized for occupational therapy purposes, as developed by facility staff, and as applicable per patient acuity levels within the individual house.
- j. Pantry off the kitchen - for storage of food and cooking supplies on shelving units and refrigerator. Size and configuration appropriate for food service delivery method selected.
 - k. Housekeeping Aides Closet - for general maintenance needs including janitor/floor sink and mop shelf/rack.
 - l. Toilet - one for Resident/Visitor use and a separate one for Staff use adjacent to common rooms.
 - m. Bathing Suite/Spa - provides assistance tub access with breakaway door and whirlpool jets. Room contains separate toilet and sink alcove, with patient lift system connecting these two areas. Desire is to provide this function in a less institutional setting, and provide a more spa like setting for resident use.
 - n. Home Gym - rehabilitation activity area for PT/OT activities in home. Space to allow for 5' x 7' mat, accessible floor space on three sides of mat, and hand wash sink.
 - o. Nurse Storage - this space is subdivided with one portion containing a VA standard omni-cell unit and the other portion a crash cart, with storage in each portion.
 - p. Laundry - residential style with washer and dryer, and millwork for use by the care givers and residents.
 - q. Soiled Utility and Clean Linen Storage rooms - as are typical in medical occupancies. The soiled room contains a Vernacare unit for bedpan disposal, sink and space for soiled linen carts. The Clean room contains a blanket warmer and room for clean linen carts.
 - r. Mechanical and electrical spaces as appropriate to support each house.
 - s. Covered patio and porch - to facilitate socialization between visitors to the campus and the other houses. These are also provided to allow residents a chance to spend time outside their house.
3. Exterior elevations are designed to reflect the adjacent campus context and are intended to be historical in character while providing a residential feel. The detailing and level of materials will be similar to those utilized on a residential townhouse, utilizing campus standard brick masonry, aluminum clad wood windows, and residential looking entrance doors. Additionally a mansard roof element clad in

architectural grade composition shingles is provided above the building parapet to assist in the shielding of rooftop equipment and added architectural detail and scale.

4. Late in the design process, it was once again noted by the design committee, that the patients currently treated by the VA staff in the existing CLC have level of care typical to a subacute care facility. This was noted as being significantly different than the self sufficient level anticipated in most VA CLC facilities outlined in the guidelines. Subacute is a level of care needed by a patient who does not require hospital acute care, but who requires more intensive skilled nursing care than is provided to the majority of patients in a skilled nursing facility. This higher acuity level is reflected in the final design configuration for this particular facility, requiring a different design approach to the final construction documents and specifications than typically anticipated within the final VA CLC design guidelines.
5. While LEED certification is not a requirement of this project, it has been designed to accommodate many of the same underlying design principles as part of this project. Extensive use of day lighting within a majority of the regularly occupied spaces is provided. Likewise, interior finish materials have been selected with both durability and environmentally friendly characteristics as would be appropriate for any medical facility. Other sustainable design features have been integrated as appropriate and are detailed further in the subsections that follow.

C. CIVIL / SITE CONCEPT

1. Building #13 is located on this site and will be removed under a separate contract prior to the start of this project. The area is relatively flat with grass and a few large trees. Excavation is required only for normal construction activity, i.e. demolition, foundations, utility work, etc.

D. EXCAVATION AND GRADING

1. The finished floor elevations are slightly higher than the surrounding existing grades to allow positive drainage from the buildings. The site grades have been designed to provide accessible routes for the new sidewalks and building entrances.

E. DOMESTIC WATER AND FIRE

1. The main domestic water line and main fire line run parallel to and east of the sidewalk west of the site, these lines will be relocated to the west to avoid conflict with Building A. The new alignments must maintain 10' minimum separation from each other as the fire line is non-potable. Domestic water to the buildings will be serviced from the new

connections to the water main west of the buildings. The connection for Building B will likely occur in the existing portion of line and the Building A connection will be in the new relocated portion.

2. Fire service for Building B will be provided by connecting to the line running adjacent to Building 13, Building A by a new connection to the line being relocated. There are 3 existing fire hydrants that should be able to remain. No others will be necessary.

F. SANITARY SEWER

1. The portion of line between manholes 8 and 9 will be removed and rerouted around Building A and new manholes will be placed to accommodate this routing. The buildings will be served by this main.

G. STORM SEWER

1. There are no existing storm sewer facilities on the site. The building roof drains will be collected and conveyed to a new disposal facility.

H. HOT WATER HEAT

1. The existing hot water heat supply and return run across a portion of the site and will need to be relocated.

I. NATURAL GAS

1. The nearest natural gas service is for Building #67, located north of the proposed site. The line will be extended to serve the site.

J. ELECTRICAL, SITE/STREET LIGHTING AND SIGNAL

1. Main electrical lines are located east of the site along the face of Building #88. A power vault is located east of the proposed building. While, no street lighting is present, some new site lites are provided in the proposed area. Signal wiring is located along the face of Building #88.

K. LANDSCAPE CONCEPT

1. The overall design theme for the CLC is one of low maintenance and clean lines with a focus on naturalized, native/adapted, and low maintenance plant material that will also blend with the adjacent VA campus landscaping. This design approach reflects sound conservation and sustainability principles as it relates to overall water use and maintenance requirements. Through the use of drought tolerant native and adapted plant materials, low volume irrigation materials and methods, and plant massing design techniques; the site landscape will require less water, maintenance, and user input over time yet still provide an attractive backdrop in concert with the architecture and an enhancement of the overall campus environment.

2. A landscaped garden/yard area is provided between to the CLC buildings. Resident use of these gardens is anticipated. Accessible pathways are provided for safe access to the various garden elements. Additionally, some portions of these paths and adjacent areas may be utilized for PT/OT gait training and other similar uses.

L. IRRIGATION SYSTEM DESIGN

1. The irrigation system shall be fitted with a single connection to the existing pressurized irrigation mainline. The irrigation control shall be an automatic controller that includes a moisture sensor for each zone in order to fully adjust the watering times with actual ground moisture readings. The primary irrigation distribution shall be low volume drip line, with bubblers serving the trees and overhead spray and/or rotor sprinklers in areas of existing/repaired turf areas. The irrigation limits for all options will vary and will extend to the areas which have been disturbed by the new construction. These areas which extend to the existing landscape shall comprise retrofitting and adjustments of the existing irrigation system and will not be controlled by the new irrigation controller for the building where possible. Irrigation system components will be coordinated to be compatible with the existing system and campus standards.

M. PLANTING DESIGN

1. The planting design shall incorporate a range of native/adapted and low water use plant materials and be organized in a way which allows plants of similar watering needs can be irrigated on the same irrigation zone. A mixture of deciduous and evergreen shrubs shall provide the structure of the foundation planting zone with ornamental grasses and perennial flowering plants being utilized for foreground interest and color. Conifer trees shall be used for screening and foundation anchors with the deciduous shade trees providing for reduction of solar gain and massing. The smaller ornamental flowering trees will be used to announce and define entry points and other features of the site and building. Being so closely located to the existing main hospital building, all new landscape planting will be carefully coordinated to complement the existing plantings.

N. LANDSCAPE REPAIR

1. Due to the location of construction for this project, it is anticipated that some areas of adjacent site will be utilized for site access or staging (as directed by the COTR). As such, repair of the landscaping in these areas including repair of turf and other landscaping in this and adjoining areas, repair of irrigation system and repair of any other site improvements in, or adjoining this area will need to be provided.

O. STRUCTURAL CONCEPT

1. The structural framing systems will consist of steel construction with girder lines at approximately 25ft. to 35 ft. on center. Light framed cold formed structural steel stud walls will flank the exterior wall lines behind a brick veneer façade. Fire resistant detailing will be utilized for all primary structural components.
2. The second floor in Building B will be supported by tube steel columns, wide flange beams and open web steel joists at regular spacing to economize layout and fabrication. Roof framing will be open web steel joists and girders with fluted 'B' deck spanning between joists. This building will include a two story elevator shaft and pit.
3. The lateral load resisting system for the one story building will utilize the steel roof deck as a series of flexible diaphragms, which will transfer loads to the walls, sheathed with steel sheets adhered to structural panels. The two story building will have similar lateral system to the one story building at the roof level whereas, the second floor will use a rigid diaphragm consisting of a lightweight concrete slab over metal deck to distribute the lateral loads to the walls.
4. Foundations will be continuous strip and isolated spread concrete footings at the building perimeter and isolated concrete spread footing at interior column locations and grade beams at interior shear walls. Both buildings will have slab on grade construction at the first floor.

P. MECHANICAL AND PLUMBING CONCEPTS

1. HVAC
 - a. The design concept for the HVAC system for this facility is to employ fan coils units hung above the ceilings throughout the facility. The fan coils will be equipped with chilled water coils for summer cooling and hot water coils for heating. The units serving the bedrooms will be placed above the ceilings at the entry of the rooms. Other units will be placed above corridors and other inconspicuous locations and will be accessed through access panels placed in the gypsum ceilings. Additionally required exhaust and ventilation will be provided through the use of an Energy Recovery Unit (ERV) on the roof of each building. This unit will provide the pressure differentials required between spaces as required by NFPA 101. By using an EVR the ventilation air will be pre-heated/pre-cooled thus saving operation costs.

- b. Heating will be provided to these buildings utilizing the facility hot water loop. A water to water heat exchanger will be placed in the mechanical room of each building. Hydronic piping will distribute heating water to the fan coil units as well as between each building.
- c. Chilled water will be generated for this facility by the use of air cooled high efficiency chillers placed on the roof. A hydronic piping system piping will distribute heating water to the fan coil units as well as between each building.

2. PLUMBING

- a. On the domestic water side, copper piping will be utilized for all supply piping within the buildings. Sanitary plumbing will be handled with cast iron or PVC piping, as indicated in the specifications. The gas piping for the medical oxygen will be installed in accordance with NFPA 99 Medical Gas Standard.

3. HOT WATER

- a. The amount of hot water in the building is expected to be rather large with the presence of showers and many sinks. In accordance with local VA campus preference a heat exchanger from the campus hot water loop will be utilized to provide domestic hot water for each building. Through use of storage tanks, this option will provide minimum 140 degree water as required by VA standards for health facilities.

Q. FIRE SPRINKLER DESIGN CONCEPTS

- 1. System will be a wet pipe, closed head, automatic fire sprinkler system designed, installed and tested in accordance with all applicable provisions of NFPA 13. Design of fire sprinkler system will be based on hydraulic calculations. Fire sprinkler systems will protect all interior, and covered exterior portions of both Building A and Building B. In accordance with local VA campus standards the system will be provided on a design-build basis based upon specification requirements.
- 2. Design of the fire sprinkler system is based on the following Occupancy Classifications: Ordinary Hazard Group II: Storage Areas, Mechanical, Electrical, Telecom, Janitorial and similar areas. Light Hazard: Offices, Corridors, Bedrooms, Common Rooms, Lobbies and similar areas.
- 3. The following sprinkler types will be utilized: Areas without Ceilings: Brass upright sprinkler, standard orifice (K=5.6), high temperature rated, quick response. Areas with Ceilings: White painted pendent sprinkler with recessed type ceiling escutcheon, standard orifice (K=5.6), ordinary temperature rated, quick response. Bedrooms: White painted residential pendent fire sprinklers with recessed type

escutcheons. All interior piping used for the fire sprinkler system shall be black steel schedule 40 piping conforming to ASTM A53A or ASTM A795.

4. In Building A, the fire sprinkler riser for wet-pipe fire sprinkler system will be located in mechanical room with exterior door. Riser will consist of a vertical double check assembly backflow preventer with supervised control valves, 2" main drain, pressure gauges, vane-type water flow switch and inspector's test valve. In Building B, the fire sprinkler riser for wet-pipe fire sprinkler system will be located in mechanical room with exterior door. Riser will consist of a vertical double check assembly backflow preventer with supervised control valves, 2" main drain, pressure gauges, vane-type water flow switch and inspector's test valve

R. ELECTRICAL/TELECOMMUNICATIONS CONCEPTS

1. Power will be provided to the facility via two transformers, one for normal power and one for emergency power. Power will be supplied from (2) 12,470 campus primary distribution transformers with 208Y/120 volt secondary. Primary distribution from existing medium voltage switches (located in S14N and E14N), primary transformers and feeders, with secondary distribution from the transformers to the Main Distribution Switchboards located on the exterior of the each respective building, will be furnished and installed under this project.
2. The electrical distribution systems to the building will be 3 phase, 4 wire, and 208Y/120 volt. Building A has Emergency Main Distribution EMD-121 and Normal Main Switchboard MSB-121. Building B has Emergency Main Switchboard EMB-122 and Normal Main Switchboard MSB-122. Branch circuit panelboards will be installed for each floor and placed as required.
3. Light levels for each of the spaces throughout the building will be designed per VA standards and as recommended by the Illuminating Engineering Society of North America where not specifically covered. Automatic controls will be used in areas where it is required per code but not in areas where it could be deemed hazardous to the occupants.
4. In addition to the typical Life Safety loads, the emergency power system will include loads for communications equipment, and other equipment and systems deemed essential to the operation of the building during a prolonged power outage.
5. Transient voltage surge suppression (TVSS) will be installed at each of the Main Distribution Switchboards with subsequent protection at local panelboards to protect the system from external surges. As no copper cable is anticipated for the telecommunications backbone, no primary

- protection will be required in the telecommunication room.
6. New underground conduits from signal manhole MH-20 will be installed to Building A and from MH21 to Building B. The conduits will extend to the second floor space in each building programmed for electrical, mechanical and telecommunications infrastructure. Within that space, the communications common equipment and termination hardware will be installed to support phone, data, cable television, nurse call, wireless data, distributed antenna system, patient wander protection and security systems. The Telecommunications Main Grounding Busbar (TMGB) will be installed in each telecommunication space and bonded to the electrical service entrance to form the telecommunications grounding system. White, fire rated plywood will be provided on the walls to support wall mounted enclosures, conduits and cabling supported in D-rings.
 7. A new backbone optical fiber cables from Building 67 will be installed to Building B of sufficient size to serve Building A, the future Medical Imaging Building and provide a new link to Building 88. A new optical fiber cable will be installed from Building B to Building A. Bid Option 8 is available to accommodate this requirement if the Medical Imaging Building is construction before this project.
 8. The existing coaxial backbone cable will be tapped to provide service to Building A in MH21 and to Building B in MH20. No multiple twisted-pair backbone cable will be installed from Building 67 to either Building A or Building B. Connections to sound, data, nurse call, irrigation control, DDC, security, fire alarm and remote monitoring systems will be via optical fiber to Building 67.
 9. Rack-mounted UPS units will be provided in the telecommunication spaces to support network equipment and POE devices in the event of power failure. The UPS units will be coordinated with the emergency power system.
 10. Distribution of telecommunications, television, security and access control cabling will be via a conduit with junction boxes above areas with suspended ceilings. Telecommunications horizontal cabling will be Category 6 unshielded twisted pair cables, terminated on 8P8C jacks per T568A pair/pinning scheme.
 11. The electrical system will be designed to meet National Electrical Code Requirements and the VA Design Guide for Research Facilities. In addition to those requirements, communications systems will be designed to meet the current version of ANSI/TIA/EIA Standards for Commercial Buildings.

1.3 STATEMENT OF BID ITEM(S)**A. Option for Increased Quantity - Separately Priced Line item:**

1. The Government may require the delivery of the numbered line item, identified in the Schedule below as an option item, in the quantity and at the price stated in the schedule below. The Contracting Officer may exercise the option by written notice to the Contractor at the time the bid is awarded. Delivery of added items shall continue at the same rate that like items are called for under the contract, unless the parties otherwise agree.

(FAR 52.217-7)

B. Evaluation of Options:

1. Except when it is determined in accordance with FAR 17.206(b) not to be in the Government's best interests, the Government will evaluate offers for award purposes by adding the total price for all options to the total price for the basic requirement. Evaluation of options will not obligate the Government to exercise the option(s).

(FAR 52.217-5)

- C. BASE BID:** Contractor shall provide all materials, equipment, labor and supervision to prepare existing site and construct two new buildings. Work includes but not limited to, general construction, walks, grading, drainage, landscaping, mechanical and electrical work utility systems, elevators and stairs. The base bid includes everything minus the work specified in bid options 1-9. The work shall be completed in accordance with the complete set of specifications and drawings.
- D. BID OPTION NO. 1:** Base Bid does not include the cost to construct Building A. Add to the Scope of the Work the Cost to Furnish and Install Building A as noted within the construction documents.
- E. BID OPTION NO. 2:** Base Bid does not include the cost to construct the Rear Porch Structure and Exterior Columns and associated elements for Building A. Base Bid does include the Concrete flatwork at grade for the exterior patio. Add to the Scope of the Work the Cost to Furnish and Install the Rear Porch Roof Structure and Exterior Columns and associated elements as shown for Building A.

- F. BID OPTION NO. 3:** Base Bid does not include the cost to construct the Rear Porch Structure and Exterior Columns and associated elements for Building B. Base Bid does include the Concrete flatwork at grade for the exterior patio. Add to the Scope of the Work the Cost to Furnish and Install the Rear Porch Roof Structure and Second Floor Exterior Patio Floor-Ceiling Structure and Exterior Columns and associated elements as shown for Building B.
- G. BID OPTION NO. 4:** Base Bid does not include the cost to Furnish and Install the Prefinished Panel System in Building A. Reference the Contract Documents for Base Bid Scope of Work. Bid Option: Furnish and Install the Interior Wainscot Assembly in Building A as shown within the Construction Documents.
- H. BID OPTION NO. 5:** Base Bid does not include the cost to Furnish and Install the Prefinished Panel System in Building B. Reference the Contract Documents for Base Bid Scope of Work. Bid Option: Furnish and Install the Interior Wainscot Assembly in Building B as shown within the Construction Documents.
- I. BID OPTION NO. 6A Site Storm Sewer System:** Base Bid does not include the cost to construct a portion of the Site Storm Sewer System as noted within the construction documents. Add to the Scope of the Work the Cost to Furnish and Install a portion of the Site Storm Drainage System as noted within the Contract Documents.
- J. BID OPTION NO. 6B Site Sanitary Sewer Manhole Assembly:** Base Bid does not include the cost to construct a Site Sanitary Sewer Manhole Assembly as shown within the construction documents. Add to the Scope of the Work the Cost to Furnish and Install a Site Sanitary Sewer Manhole Assembly as shown within the Contract Documents.
- K. BID OPTION NO. 6C Site Potable Water Line:** Base Bid does not include the cost to construct a portion of the Site Potable Water Line as shown within the construction documents. Add to the Scope of the Work the Cost to Furnish and Install a portion of the Site Potable Water Line as shown within the Contract Documents.
- L. BID OPTION NO. 6D:** Base Bid does not include the cost to remove the approximately 55 LF portion of the Potable Water Line indicated in the construction documents. Add to the Scope of Work the Cost of remove the portion of Potable Water Line as shown within the Contract Documents.
- M. BID OPTION NO. 6E:** Base Bid does not include the cost to remove the trees/bushes indicated as "Bid Option 6E" in the construction documents. Add to the Scope of Work the Cost of remove the trees/bushes as shown within the Contract Documents.

N. BID OPTION NO. 7: NOT USED

O. BID OPTION NO. 8: Base Bid: Furnish, Install and Terminate 72 strands of Optical Fiber Cables from Building 67 to Building B as shown and noted in the contract documents. Bid Option: Furnish, Install and Terminate 24 strands of Optical Fiber Cables from the Medical Imaging Building to Building B as shown and noted in the Contract Documents.

P. BID OPTION NO. 9: Base Bid does not include Interior Window coverings. Add to the Scope of the Work the cost to Furnish and Install the Interior Window Coverings as shown in the Contract Documents. 1.3

SPECIFICATIONS AND DRAWINGS FOR CONTRACTOR

A. AFTER AWARD OF CONTRACT, 1 Compact Disk (CD) of specifications and drawings in PDF format will be furnished to the Contractor.

1.4 CONSTRUCTION SECURITY REQUIREMENTS

A. Security Plan:

1. The security plan defines both physical and administrative security procedures that will remain effective for the entire duration of the project.
2. The General Contractor is responsible for assuring that all sub-contractors working on the project and their employees also comply with these regulations.

B. Security Procedures:

1. All general contractor's employees, subcontractors, and material suppliers entering the Medical Center consent to search by VA police at any time. The areas of search shall be all encompassing including but not limited to: their person; their personal effects; personal vehicles, as well as any and all contractor vehicles, equipment, trailers, offices, storage shed, tool boxes and any and all containers.
2. For working outside the "regular hours" as defined in the contract, the General Contractor shall give 3 days notice to the Contracting Officer so that security can be provided for the employees. This notice is separate from any notices required for utility shutdown described later in this section.
3. No photography of VA premises is allowed without written permission of the Contracting Officer.
4. VA reserves the right to close down or shut down the project site and order General Contractor's employees off the premises in the event of a national emergency. The General Contractor may return to the site only with the written approval of the Contracting Officer.

C. Contractor Identification:

1. The Contractor's Project Manager shall be issued a badge identifying him/her as an authorized visitor on the Medical center. The Project Manager shall wear the badge displayed prominently at all times when on site. The Contractor shall return the badge at the conclusion of the project. The Contractor shall within 24 hours notify the Veterans Affairs Police Services and the Contracting Officer if the badge has been lost.
2. The Contractor shall initiate an identification program for each of its employees, subcontractors, and subcontractor employees when on the Medical Center property. Each person will be identified with a unique readily visible badge identifying the person and that the person is under the direction of the General Contractor. Every employee or subcontractor shall wear the badge displayed prominently at all times when on site.

D. Key Control:

1. The General Contractor shall provide duplicate keys and lock combinations to the COTR for the purpose of security inspections of every area of project including tool boxes and parked machines and take any emergency action as necessary.

E. Document Control:

1. The General Contractor is responsible for safekeeping of all drawings, project manual and other project information. This information shall be shared only with those with a specific need to accomplish the project.
2. All paper waste or electronic media such as CD's and diskettes shall be shredded and destroyed in a manner acceptable to the VA.
3. Notify Contracting Officer and Site Security Officer immediately when there is a loss or compromise of "sensitive information".
4. At the completion of the project, the Contractor shall secure all copies of drawings and specifications from its office and all subcontractors and return them to the Government.

F. Motor Vehicle Restrictions:

1. Only properly licensed motor vehicles with valid insurance shall enter the Medical Center. Drivers of such vehicles will possess on their person a valid license for the type of vehicle being driven. Vehicle access to the construction site shall be restricted to active picking up and dropping off materials and supplies.
2. Parking is strictly limited on the Medical Center. Contractor employee/subcontractor employee parking shall be restricted to either Mt. Cove parking lot or Contractor's row at the North end of the

facility specifically excluding parking lots 6 and 10. Additional restrictions may be enforced based on patient and staff needs as determined by the Contracting Officer.

3. Maintain sidewalk access to back side of Building 88. Provide minimal disruption only during actual demolition and replacement of this sidewalk. This sidewalk will remain a means of egress for Building 88.

G. Personal Conduct:

1. Every person who enters the Medical Center's grounds is expected to conduct themselves in a professional responsible manner without the need to enumerate every expected or prohibited behavior.
2. Weapons, ammunition, explosives, and alcoholic beverages are prohibited on the Medical Center's grounds.
3. There shall be no solicitations or sales of any kind on the Medical Center's grounds.
4. The Government reserves the right to refuse to permit employment on the Work or require dismissal from the work of any subcontractor who, by reason of previous unsatisfactory work on Department of Veterans Affairs project or for any other reason, is considered by the contracting officer to be incompetent or otherwise objectionable.

(Reference VAAR 852.236-80)

1.4 FIRE SAFETY

A. Applicable Publications: Publications listed below form part of this Article to extent referenced. Publications are referenced in text by basic designations only.

1. American Society for Testing and Materials (ASTM):
 - E84-2007 Surface Burning Characteristics of Building Materials
2. National Fire Protection Association (NFPA):
 - 10-2010Standard for Portable Fire Extinguishers
 - 30-2008Flammable and Combustible Liquids Code
 - 51B-2009Standard for Fire Prevention During Welding, Cutting and Other Hot Work
 - 70-2008National Electrical Code
 - 241-2009Standard for Safeguarding Construction, Alteration, and Demolition Operations
3. Occupational Safety and Health Administration (OSHA):
 - 29 CFR 1926Safety and Health Regulations for Construction

B. Fire Safety Plan: Establish and maintain a fire protection program in accordance with 29 CFR 1926. Prior to start of work, prepare a plan detailing project-specific fire safety measures, including periodic

status reports, and submit to COTR and Safety Officer for review for compliance with contract requirements in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA AND SAMPLES. The plan shall include as a minimum means of egress, egress routes, assembly area, fire extinguishers, fire alarm notification methods, and job specific fire hazards. Prior to any worker for the contractor or subcontractors beginning work, they shall undergo a safety briefing provided by the general contractor's competent person per OSHA requirements. This briefing shall include information on the construction limits, VAMC safety guidelines, means of egress, break areas, work hours, locations of restrooms, use of VAMC equipment, etc. Documentation shall be provided to the Resident Engineer that individuals have undergone contractor's safety briefing. Contractor is to perform weekly fire hazard and OSHA safety inspections of the entire construction area from the time construction starts until the area is accepted by the Government. A copy of these reports, listing all hazards identified and corrective actions taken, is to be provided weekly to the COTR.

- C. Site and Building Access: Maintain free and unobstructed access to facility emergency services and for fire, police and other emergency response forces in accordance with NFPA 241.
- D. Separate temporary facilities, such as trailers, storage sheds, and dumpsters, from existing buildings and new construction by distances in accordance with NFPA 241. For small facilities with less than 6 m (20 feet) exposing overall length, separate by 3m (10 feet).
- E. Temporary Heating and Electrical: Install, use and maintain installations in accordance with 29 CFR 1926, NFPA 241 and NFPA 70. Open flame heating devices are prohibited on the Medical Center Grounds.
- F. Means of Egress: Do not block exiting for occupied buildings, including paths from exits to roads. Minimize disruptions and coordinate with COTR.
- G. Egress Routes for Construction Workers: Maintain free and unobstructed egress. Inspect daily. Report findings and corrective actions weekly COTR.
- H. Fire Extinguishers: Provide and maintain extinguishers in construction areas and temporary storage areas in accordance with 29 CFR 1926, NFPA 241 and NFPA 10.
- I. Flammable and Combustible Liquids: Store, dispense and use liquids in accordance with 29 CFR 1926, NFPA 241 and NFPA 30.
- J. Smoke Detectors: Prevent accidental operation. Remove temporary covers at end of work operations each day. Coordinate with COTR.

- K. Hot Work: Perform and safeguard hot work operations in accordance with NFPA 241 and NFPA 51B. The contractor shall be responsible for assigning an authorized supervisory representative to issue hot work permits. Before any cutting or welding with open flame is conducted, the contractor or subcontractor shall obtain permission from the contractor's authorized representative by the issuance of this permit. Coordinate with Project Manager prior to issuing of any hot work permits. See Attachment A at the end of the section, for sample of hot work permit.
- L. Fire Hazard Prevention and Safety Inspections: Inspect and provide a written report weekly for fire hazards and safety problems for the entire construction areas. These inspections shall begin from the notice to proceed until the acceptance of the entire project by the Contracting Officer. Coordinate with, and report findings and corrective actions weekly to COTR.
- M. Smoking: Smoking is prohibited in and adjacent to construction areas, including all vehicles, parking lots and trailers; inside existing buildings; on building roofs; in crawl spaces, etc. in separate and detached buildings, smoking is also prohibited, except in designated smoking rest areas.
- N. Dispose of waste and debris in accordance with NFPA 241. Remove from buildings daily.
- O. Perform other construction, alteration and demolition operations in accordance with 29 CFR 1926. 1.5

OPERATIONS AND STORAGE AREAS

- A. Any and all construction activities shall be secondary to the Mission of the Medical Center. Various construction activities may be restricted to certain hours including only after normal working hours or on weekends or holidays as necessary. Even scheduled activities may be postponed or revised based on the needs of the Medical Center.
- B. The Contractor, its employees, subcontractors, subcontractor employees and material suppliers are subject to all Veterans Health Administration (VHA), Medical Center (BVAMC), and Facilities Management Service (FMS) directives and memorandums. These documents are available for review in the FMS office.
- C. The Contractor shall confine all operations (including storage of materials) on Government premises to areas authorized or approved by the Contracting Officer. The Contractor shall hold and save the Government, its officers and agents, free and harmless from liability of any nature occasioned by the Contractor's performance.

- D. Temporary buildings (e.g., storage sheds, shops, offices) and utilities may be erected by the Contractor only with the approval of the Contracting Officer and shall be built with labor and materials furnished by the Contractor without expense to the Government. The temporary buildings and utilities shall remain the property of the Contractor and shall be removed by the Contractor at its expense upon completion of the work. With the written consent of the Contracting Officer, the buildings and utilities may be abandoned and need not be removed.
- E. The Contractor shall, under regulations prescribed by the Contracting Officer, use only established roadways, or use temporary roadways constructed by the Contractor when and as authorized by the Contracting Officer. When materials are transported in prosecuting the work, vehicles shall not be loaded beyond the loading capacity recommended by the manufacturer of the vehicle or prescribed by any Federal, State, or local law or regulation. When it is necessary to cross curbs or sidewalks, the Contractor shall protect them from damage. The Contractor shall repair or pay for the repair of any damaged curbs, sidewalks, or roads.
1. Maintain sidewalk access to back side of Building 88. Provide minimal disruption only during actual demolition and replacement of this sidewalk. This sidewalk will remain a means of egress for Building 88.
- F. Working space and space available for storing materials shall be as determined by the COTR.
- G. Execute work so as to interfere as little as possible with normal functioning of Medical Center as a whole, including operations of utility services, fire protection systems and any existing equipment, and with work being done by others. Keep roads clear of construction materials, debris, standing construction equipment and vehicles at all times. Use of equipment and tools that transmit vibrations and noises through the building structure, are not permitted in buildings that are occupied, during construction, jointly by patients or medical personnel, and Contractor's personnel, except as permitted by COTR where required by limited working space. Additionally, Contractor may be restricted further than OSHA allowable limits in terms of vehicle and construction emissions, odors, noises, core drilling, hammer drilling, jack hammering, etc.
1. Do not store materials and equipment in other than assigned areas.
 2. Schedule delivery of materials and equipment to immediate construction working areas within buildings in use by Department of

Veterans Affairs in quantities sufficient for not more than two work days. Provide unobstructed access to Medical Center areas required to remain in operation.

3. Where access by Medical Center personnel to vacated portions of buildings is not required, storage of Contractor's materials and equipment will be permitted subject to fire and safety requirements.
- H. Phasing: To insure such executions, Contractor shall furnish the COTR with a schedule of approximate dates on which the Contractor intends to accomplish work in each specific area of site, building or portion thereof. In addition, Contractor shall notify the COTR two weeks in advance of the proposed date of starting work in each specific area of site, building or portion thereof. Arrange such dates to insure accomplishment of this work in successive phases mutually agreeable to Medical Center Director, COTR and Contractor. Contractor shall take all measures and provide all material necessary for protecting existing equipment and property in affected areas of construction against dust and debris, so that equipment and affected areas to be used in the Medical Centers operations will not be hindered. Contractor shall permit access to Department of Veterans Affairs personnel and patients through other construction areas which serve as routes of access to such affected areas and equipment. Coordinate alteration work in areas occupied by Department of Veterans Affairs so that Medical Center operations will continue during the construction period.
- I. Construction Fence: Before construction operations begin, Contractor shall provide a substantial construction fence acceptable to the COTR, around the construction area indicated on the drawings. Provide gates as required for access with necessary hardware, including hasps and padlocks. Fasten fence fabric to terminal posts with tension bands and to line posts and top and bottom rails with tie wires spaced at maximum 375 mm (15 inches). Bottom of fences shall extend to 25 mm (one inch) above grade. Remove the fence when directed by COTR.
- J. Utilities Services: Maintain existing utility services for Medical Center at all times. Provide temporary facilities, labor, materials, equipment, connections, and utilities to assure uninterrupted services. Where necessary to cut existing water, steam, gases, sewer or air pipes, or conduits, wires, cables, etc. of utility services or of fire protection systems and communications systems (including telephone), they shall be cut and capped at suitable places where shown; or, in absence of such indication, where directed by COTR.
1. No utility service such as water, gas, steam, sewers or electricity, or fire protection systems and communications systems may be

interrupted without prior approval of COTR. Electrical work shall be accomplished with all affected circuits or equipment de-energized. When an electrical outage cannot be accomplished, work on any energized circuits or equipment shall not commence without the Medical Center Director's prior knowledge and written approval. Refer to specification Sections 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS, 27 05 11 REQUIREMENTS FOR COMMUNICATIONS INSTALLATIONS and 28 05 11, REQUIREMENTS FOR ELECTRONIC SAFETY AND SECURITY INSTALLATIONS for additional requirements.

2. Contractor shall submit a request to interrupt any such services to COTR, in writing, a minimum of 48 hours in advance of proposed interruption. Request shall state reason, date, exact time of, and approximate duration of such interruption.
3. Contractor will be advised (in writing) of approval of request, or of which other date and/or time such interruption will cause least inconvenience to operations of Medical Center. Interruption time approved by Medical Center may occur at other than Contractor's normal working hours.
4. Major interruptions of any system must be requested, in writing, at least 15 calendar days prior to the desired time and shall be performed as directed by the COTR.
5. In case of a contract construction emergency, service will be interrupted on approval of COTR. Such approval will be confirmed in writing as soon as practical.
6. The VA will shut down existing utility system as necessary for the Contractor to perform required work on the utility. The Contractor shall be responsible for draining existing wet systems, such as water, chilled water, heating water etc. as required to accomplish new work. Contractor shall also be responsible for re-filling systems including adding chemicals as required. Contractor shall be further responsible for returning the utility to its proper operating state including but not limited to: removal of air entrainment; rebalancing of throttling valves or dampers; verification of the proper operation of any control system. It is acceptable to salvage existing treated water in clean storage containers approved by the VA, and re-inject it into the system upon completion of the work. Any treated water not re-injected shall be disposed of in accordance with project specifications.

7. Whenever it is required that a connection fee be paid to a public utility provider for new permanent service to the construction project, for such items as water, sewer, electricity, gas or steam, payment of such fee shall be the responsibility of the Government and not the Contractor.
- K. Abandoned Lines: All service lines such as wires, cables, conduits, ducts, pipes and the like, and their hangers or supports, which are to be abandoned are to be removed entirely back to the point of connection to the active utility (i.e. piping and cutwork back to active mains, electrical wires and cables back to active circuitry and all empty raceways). If items are noted to be abandoned in place, they shall be sealed, capped or plugged. The lines shall not be capped in finished areas, but shall be removed and sealed, capped or plugged in ceilings, within furred spaces, in unfinished areas, or within walls or partitions; so that they are completely behind the finished surfaces.
- L. To minimize interference of construction activities with flow of Medical Center traffic, comply with the following:
1. Keep roads, walks and entrances to grounds, to parking and to occupied areas of buildings clear of construction materials, debris and standing construction equipment and vehicles. Wherever excavation for new utility lines cross existing roads, at least one lane must be open to traffic at all times unless an alternate route is identified and Contractor provides adequate temporary barriers signage and direction for detours.
 2. Method and scheduling of required cutting, altering and removal of existing roads, walks, and entrances must be approved by the COTR.
 3. The Contractor shall conform to the Manual on Uniform Traffic Control Devices 2009 Edition Part 6 Temporary Traffic Control.
- M. Coordinate the work for this contract with other construction operations as directed by COTR. This includes the scheduling of traffic and the use of roadways, as specified in Article, USE OF ROADWAYS. (Reference FAR 52.236-10.)
- N. The Contractor shall at all times keep the work area, including storage areas, free from accumulation of waste materials. Before completing the work, the Contractor shall remove from the work and premises any rubbish, tools, scaffolding, equipment, and materials that are not the property of the Government. Upon completing the work, the Contractor shall leave the work area in a clean, neat, and orderly condition satisfactory to the Contracting Officer.

(Reference FAR 52.236-10 in General Conditions)

1.6 INFECTION PREVENTION MEASURES

- A. Implement the requirements of Veterans Affairs Medical Center's (VAMC's) Infection Control Risk Assessment (ICRA) team. ICRA Group may monitor dust in the vicinity of the construction work and require the Contractor to take corrective action immediately if the safe levels are exceeded.
- B. Establish and maintain a dust control program as part of the contractor's infection preventive measures in accordance with the guidelines provided by ICRA Group. Prior to start of work, prepare a plan detailing project-specific dust protection measures, including periodic status reports, and submit to COTR and Facility ICRA team for review for compliance with contract requirements in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA AND SAMPLES.
 - 1. All personnel involved in the construction or renovation activity shall be educated and trained in infection prevention measures established by the Medical Center.
- C. Final Cleanup:
 - 1. Upon completion of project, or as work progresses, remove all construction debris from above ceiling, vertical shafts and utility chases that have been part of the construction.
 - 2. Perform HEPA vacuum cleaning of all surfaces in the construction area. This includes walls, ceilings, cabinets, furniture (built-in or free standing), partitions, flooring, etc.
 - 3. All new air ducts shall be cleaned prior to final inspection.
- D. Also reference Specification 01 57 19 TEMPORARY ENVIRONMENTAL

CONTROLS. 1.7 PROTECTION OF EXISTING VEGETATION, STRUCTURES, EQUIPMENT, UTILITIES, AND IMPROVEMENTS

- A. The Contractor shall repair any damage to those facilities, including those that are the property of a third party, resulting from failure to comply with the requirements of this contract or failure to exercise reasonable care in performing the work. If the Contractor fails or refuses to repair the damage promptly, the Contracting Officer may have the necessary work performed and charge the cost to the Contractor.

(FAR 52.236-9)

- B. Refer to Section 01 57 19, TEMPORARY ENVIRONMENTAL CONTROLS, for additional requirements on protecting vegetation, soils and the environment. Refer to Articles, "Alterations", "Restoration", and "Operations and Storage Areas" for additional instructions concerning repair of damage to structures and site improvements.

1.8 RESTORATION

- A. Remove, cut, alter, replace, patch and repair existing work as necessary to install new work. Except as otherwise shown or specified, do not cut,

alter or remove any structural work, and do not disturb any ducts, plumbing, steam, gas, or electric work without approval of the COTR. Existing work to be altered or extended and that is found to be defective in any way, shall be reported to the COTR before it is disturbed. Materials and workmanship used in restoring work, shall conform in type and quality to that of original existing construction, except as otherwise shown or specified.

- B. Contractor shall saw cut at lines shown on the drawings all concrete, asphalt and other materials where demolition or alteration is to occur. Any damage outside of the cut lines shall be cut out by proper saw cutting creating a neat repair at no additional cost to the Government.
- C. Upon completion of contract, deliver work complete and undamaged. Existing work (walls, ceilings, partitions, floors, mechanical and electrical work, lawns, paving, roads, walks, etc.) disturbed or removed as a result of performing required new work, shall be patched, repaired, reinstalled, or replaced with new work, and refinished and left in as good condition as existed before commencing work.
- D. At Contractor's own expense, Contractor shall immediately restore to service and repair any damage caused by Contractor's workmen to existing piping and conduits, wires, cables, etc., of utility services or of fire protection systems and communications systems (including telephone) which are indicated on drawings and which are not scheduled for discontinuance or abandonment.
- E. The drawings show the general location of exiting utilities. The Contractor shall at its own expense verify exact locations and elevations of utilities and make adjustments of the Work to accommodate such utilities. Expense of repairs to such utilities and systems not shown on drawings will be covered by adjustment to contract time and price in accordance with clause entitled "CHANGES" (FAR 52.243-4 and VAAR 852.236-88) and "DIFFERING SITE CONDITIONS" (FAR 52.236-2) of Section 00 72 00, GENERAL CONDITIONS.

1.9 PHYSICAL DATA

- A. Data and information furnished or referred to below is for the Contractor's information. The Government shall not be responsible for any interpretation of or conclusion drawn from the data or information by the Contractor.
- B. Government does not guarantee that other materials will not be encountered nor that proportions, conditions or character of several materials will not vary from those indicated by Drawings. Specifically the Department of Veterans Affairs makes no indication of depth of water levels below grade. Bidders are expected to examine site of work and

decide for themselves character of materials and make their bids accordingly. Upon proper application to Department of Veterans Affairs, bidders will be permitted to make subsurface explorations of their own at site.

1.10 PROFESSIONAL SURVEYING SERVICES

A registered professional land surveyor or registered civil engineer whose services are retained and paid for by the Contractor shall perform services specified herein and in other specification sections. The Contractor shall certify that the land surveyor or civil engineer is not one who is a regular employee of the Contractor, and that the land surveyor or civil engineer has no financial interest in this contract.

1.11 LAYOUT OF WORK

- A. The Contractor shall lay out the work from Government established base lines and bench marks, indicated on the drawings, and shall be responsible for all measurements in connection with the layout. The Contractor shall furnish, at Contractor's own expense, all stakes, templates, platforms, equipment, tools, materials, and labor required to lay out any part of the work. The Contractor shall be responsible for executing the work to the lines and grades that may be established or indicated by the Contracting Officer. The Contractor shall also be responsible for maintaining and preserving all stakes and other marks established by the Contracting Officer until authorized to remove them. If such marks are destroyed by the Contractor or through Contractor's negligence before their removal is authorized, the Contracting Officer may replace them and deduct the expense of the replacement from any amounts due or to become due to the Contractor.

(FAR 52.236-17)

- B. Establish and plainly mark such other lines and grades that are reasonably necessary to properly assure that location, orientation, and elevations established for each such structure roads, parking lots, are in accordance with lines and elevations shown on contract drawings.
- C. Following completion of general mass excavation and before any other permanent work is performed, establish and plainly mark (through use of appropriate batter boards or other means) sufficient additional survey control points or system of points as may be necessary to assure proper alignment, orientation, and grade of all major features of work. Survey shall include, but not be limited to, location of lines and grades of footings, exterior walls, center lines of columns in both directions, major utilities and elevations of floor slabs:
1. Such additional survey control points or system of points thus established shall be checked and certified by a registered land

- surveyor or registered civil engineer. Furnish such certification to the COTR before any work (such as footings, floor slabs, columns, walls, utilities and other major controlling features) is placed.
- D. Whenever changes from contract drawings are made in line or grading requiring certificates, record such changes on a reproducible drawing bearing the registered land surveyor or registered civil engineer seal, and forward these drawings upon completion of work to COTR.
- E. The Contractor shall perform the surveying and layout work of this and other articles and specifications in accordance with the provisions of Article "Professional Surveying Services".
- F. The Contractor shall keep on the work site a copy of the drawings and specifications and shall at all times give the Contracting Officer and COTR access thereto. Anything mentioned in the specification and not shown on the drawings, or shown on the drawings and not mentioned in the specifications, shall be of like effect as if shown or mentioned in both. In case of difference between drawings and specifications, the specifications shall govern. In case of discrepancy in the figures, in the drawings, or in the specifications, the matter shall be promptly submitted to the Contracting Officer, who shall promptly make a determination in writing. Any adjustment by the Contractor without such a determination shall be at the Contractor's own risk and expense. The Contracting Officer shall furnish from time to time such detailed drawings and other information as considered necessary unless otherwise provided.
- G. Wherever in the specifications or upon the drawings the words "directed", "required", "ordered", "designated", "prescribed", or words of like import are used, it shall be understood that the "direction", "requirement", "order", "designation", or "prescription", of the Contracting Officer is intended and similarly the words "approved", "acceptable", "satisfactory", or words of the like import shall mean "approved by", or "acceptable to", or "satisfactory to" the Contracting Officer, unless otherwise expressly stated.
- H. Where "as shown", "as indicated", "as detailed", or words of similar import are used, it shall be understood that the reference is made to the drawings accompanying this contract unless stated otherwise. The word "provided" as used herein shall be understood to mean "provide complete in place" that is "furnished and installed".
- I. Shop drawings means drawings, submitted to the Government by the Contractor, subcontractor, or any lower tier subcontractor pursuant to a construction contract, showing in detail (1) the proposed fabrication and assembly of structural elements and (2) the installation (i.e.,

form, fit, and attachment details) of materials or equipment. It includes drawings, diagrams, layouts, schematics, descriptive literature, illustrations, schedules, performance and test data, and similar materials furnished by the contractor to explain in detail specific portions of the work required by the contract. The Government may duplicate, use, and disclose in any manner and for any purpose shop drawings delivered under this contract.

- J. If this contract requires submittals or shop drawings, the Contractor shall coordinate all such submittals or drawings, and review them for accuracy, completeness, and compliance with contract requirements and shall indicate its approval thereon as evidence of such coordination and review. Submittals and shop drawings submitted to the Contracting Officer without evidence of the Contractor's approval may be returned for resubmission. The Contracting Officer will indicate an approval or disapproval of the submittals or shop drawings and if not approved as submitted shall indicate the Government's reasons therefore. Any work done before such approval shall be at the Contractor's risk. Approval by the contracting Officer shall not relieve the Contractor from responsibility for any errors or omissions in such submittals or drawings, nor from responsibility for complying with the requirements of this contract, except with respect to variations described and approved in accordance with (K) below.
- K. If submittals or shop drawings show variations from the contract requirements, the Contractor shall describe such variations in writing, separate from the submittal or drawings, at the time of submission. If the Contracting Officer approves any such variation, the Contracting Officer shall issue an appropriate contract modification, except that, if the variation is minor or does not involve a change in price or in time of performed, a modification need not be issued.
- L. The Contractor shall submit to the Contracting Officer for approval four copies (unless otherwise indicated) of all shop drawings as called for under the various headings of these specifications. Three sets (unless otherwise indicated) of all shop drawings, will be retained by the Contracting Officer and one set will be returned to the Contractor.
- M. Upon completing the work under this contract, the Contractor shall furnish two complete sets of all shop drawings as finally approved. These drawings shall show all changes and revisions made up to the time the equipment is completed and accepted.
- N. The Contracting Officer's interpretation of the drawings and specification will be final, subject to the disputes clause.
- O. Large scale drawings supersede small scale drawings.

- P. Dimensions govern in all cases. Scaling of drawings may be done only for general location and general size of items.
- Q. Dimensions shown of existing work and all dimensions required for work that is to connect with existing work, shall be verified by the Contractor by actual measurement of the existing work. Any work at variance with that specified or shown in the drawings shall not be performed by the Contractor until approved in writing by the Contracting Officer.

1.12 AS-BUILT DRAWINGS

- A. The contractor shall maintain two full size sets of as-built drawings which will be kept current during construction of the project, to include all contract changes, modifications and clarifications.
- B. All variations shall be shown in the same general detail as used in the contract drawings. To insure compliance, as-built drawings shall be made available for the COTR's review, as often as requested.
- C. Contractor shall deliver one approved completed set of as-built drawings to the COTR within 15 calendar days after each completed phase and after the acceptance of the project by the COTR.
- D. Paragraphs A, B, & C shall also apply to all shop drawings.
- E. Failure to keep as-built drawings up-to-date shall be cause for withholding payments.
- F. Contractor is to provide an updated sequence of operation in digital format indicating all changes made to the original sequence of operation.

1.13 USE OF ROADWAYS

- A. For hauling, use only established public roads and roads on /Medical Center property and, when authorized by the COTR, such temporary roads which are necessary in the performance of contract work. Temporary roads shall be constructed by the Contractor at Contractor's expense. When necessary to cross curbing, sidewalks, or similar construction, they must be protected by well-constructed bridges.
- B. When new permanent roads are to be a part of this contract, Contractor may construct them immediately for use to facilitate building operations. These roads may be used by all who have business thereon within zone of building operations.
- C. Maintain sidewalk access to back side of Building 88. Provide minimal disruption only during actual demolition and replacement of this sidewalk. This sidewalk will remain a means of egress for Building 88.

1.14 RESIDENT ENGINEER'S FIELD OFFICE - NOT USED

1.15 TEMPORARY USE OF MECHANICAL AND ELECTRICAL EQUIPMENT

- A. Use of new installed mechanical and electrical equipment to provide heat, ventilation, plumbing, light and power will be permitted subject to compliance with the following provisions:
1. Permission to use each unit or system must be given by the COTR. If the equipment is not installed and maintained in accordance with the following provisions, the COTR will withdraw permission for use of the equipment.
 2. Electrical installations used by the equipment shall be completed in accordance with the drawings and specifications to prevent damage to the equipment and the electrical systems, i.e. transformers, relays, circuit breakers, fuses, conductors, motor controllers and their overload elements shall be properly sized, coordinated and adjusted. Voltage supplied to each item of equipment shall be verified to be correct and it shall be determined that motors are not overloaded. The electrical equipment shall be thoroughly cleaned before using it and again immediately before final inspection including vacuum cleaning and wiping clean interior and exterior surfaces.
 3. Units shall be properly lubricated, balanced, and aligned. Vibrations must be eliminated.
 4. Automatic temperature control systems for preheat coils shall function properly and all safety controls shall function to prevent coil freeze-up damage.
 5. The air filtering system utilized shall be that which is designed for the system when complete, and all filter elements shall be replaced at completion of construction and prior to testing and balancing of system.
 6. All components of heat production and distribution system, metering equipment, condensate returns, and other auxiliary facilities used in temporary service shall be cleaned prior to use; maintained to prevent corrosion internally and externally during use; and cleaned, maintained and inspected prior to acceptance by the Government.
- B. Prior to final inspection, the equipment or parts used which show wear and tear beyond normal, shall be replaced with identical replacements, at no additional cost to the Government.
- C. This paragraph shall not reduce the requirements of the mechanical and electrical specifications sections.

1.16 TEMPORARY USE OF NEW ELEVATORS - NOT USED

1.17 TEMPORARY TOILETS

- A. Provide where directed, (for use of all Contractor's workmen) ample temporary sanitary toilet accommodations with suitable sewer and water

connections; or provide suitable dry closets where directed. Keep such places clean and free from flies, and all connections and appliances connected therewith are to be removed prior to completion of contract, and premises left perfectly clean. Contractor shall further comply with 29 CFR 1926 Subpart D. The Government may direct relocation of temporary facilities as needs of the Medical Center change.

1.18 AVAILABILITY AND USE OF UTILITY SERVICES

- A. Heat: Furnish temporary heat necessary to prevent injury to work and materials through dampness and cold. Use of open salamanders or any temporary heating devices which may be fire hazards or may smoke and damage finished work, will not be permitted. Maintain minimum temperatures as specified for various materials.
- B. Electricity (for Construction and Testing): Furnish all temporary electric services.
 - 1. Obtain electricity by connecting to the Medical Center electrical distribution system using OSHA and NEC approved GFI equipment for all electrical connections to the Medical Center. The Contractor shall meter and pay for electricity required for electric cranes. Electricity for all other uses is available at no cost to the Contractor.
- C. Water (for Construction and Testing): Furnish temporary water service.
 - 1. Obtain water by connecting to the Medical Center water distribution system. Provide reduced pressure backflow preventer at each connection. Water is available at no cost to the Contractor.
 - 2. Maintain connections, pipe, fittings and fixtures and conserve water-use so none is wasted. Failure to stop leakage or other wastes will be cause for revocation (at COTR's discretion) of use of water from Medical Center's system.

(Reference FAR 52.236-14 in General Conditions)

1.19 NEW TELEPHONE EQUIPMENT

- A. The Contractor shall coordinate with the Work of installation of telephone equipment. This Work shall be completed prior to final inspection and acceptance the by the Government.

1.20 TESTS

- A. Pre-test mechanical and electrical equipment and systems and make corrections required for proper operation of such systems before requesting final tests. Final test will not be conducted unless pre-tested.
- B. Conduct final tests required in various sections of specifications in presence of an authorized representative of the Contracting Officer.

Contractor shall furnish all labor, materials, equipment, instruments, and forms, to conduct and record such tests.

- C. Mechanical and electrical systems shall be balanced, controlled and coordinated. A system is defined as the entire complex which must be coordinated to work together during normal operation to produce results for which the system is designed. For example, air conditioning supply air is only one part of entire system which provides comfort conditions for a building. Other related components are return air, exhaust air, steam, chilled water, refrigerant, hot water, controls and electricity, etc. Another example of a complex which involves several components of different disciplines is a boiler installation. Efficient and acceptable boiler operation depends upon the coordination and proper operation of fuel, combustion air, controls, steam, feedwater, condensate and other related components.
- D. All related components as defined above shall be functioning when any system component is tested. Tests shall be completed within a reasonably short period of time during which operating and environmental conditions remain reasonably constant.
- E. Individual test result of any component, where required, will only be accepted when submitted with the test results of related components and of the entire system.

1.21 INSTRUCTIONS

- A. Contractor shall furnish Maintenance and Operating manuals and verbal instructions when required by the systems as further defined in section 1.21 above; various sections of the specifications; and as hereinafter specified no later than 2 weeks prior to final inspection.
- B. Manuals: Maintenance and operating manuals (four copies each) for each separate piece of equipment shall be delivered to the COTR coincidental with the delivery of the equipment to the job site. Manuals shall be complete, detailed guides for the maintenance and operation of equipment. They shall include complete information necessary for starting, adjusting, maintaining in continuous operation for long periods of time and dismantling and reassembling of the complete units and sub-assembly components. Manuals shall include an index covering all component parts clearly cross-referenced to diagrams and illustrations. Illustrations shall include "exploded" views showing and identifying each separate item. Emphasis shall be placed on the use of special tools and instruments. The function of each piece of equipment, component, accessory and control shall be clearly and thoroughly explained. All necessary precautions for the operation of the equipment and the reason for each precaution shall be clearly set forth. Manuals must reference

the exact model, style and size of the piece of equipment and system being furnished. Manuals referencing equipment similar to but of a different model, style, and size than that furnished will not be accepted.

- C. Instructions: Contractor shall provide qualified, factory-trained manufacturers' representatives to give detailed instructions to assigned Department of Veterans Affairs personnel in the operation and complete maintenance for each piece of equipment. All such training will be at the job site. These requirements are more specifically detailed in the various technical sections. Instructions for different items of equipment that are component parts of a complete system, shall be given in an integrated, progressive manner. All instructors for every piece of component equipment in a system shall be available until instructions for all items included in the system have been completed. This is to assure proper instruction in the operation of inter-related systems. All instruction periods shall be at such times as scheduled by the COTR and shall be considered concluded only when COTR is satisfied in regard to complete and thorough coverage. The Department of Veterans Affairs reserves the right to request the removal of, and substitution for, any instructor who, in the opinion of the COTR, does not demonstrate sufficient qualifications in accordance with requirements for instructors above.

1.22 GOVERNMENT-FURNISHED EQUIPMENT (GFE) - NOT USED

1.23 GOVERNMENT-FURNISHED PROPERTY

- A. The Government shall deliver to the Contractor, the Government-furnished property shown on the Schedule and drawings.
- B. Equipment furnished by Government to be installed by Contractor will be furnished to Contractor at the Medical Center.
- C. Contractor shall be prepared to receive this equipment from Government and store or place such equipment not less than 90 days before Completion Date of project.
- D. Storage space for equipment will not be provided by the Government and the Contractor shall be prepared to unload and store such equipment therein upon its receipt at an off-site location meeting the following requirements:
1. Off-site storage location(s) for government furnished property/materials must be located less than 30 miles from the Project site and inside the state of Idaho. Proposed location must be submitted in writing to the Contracting Officer and COTR and approved in advance of storing property.

2. All government furnished property/materials stored off-site must be segregated and clearly marked with the VA project number and as being the "Property of the Veterans Administration".
 3. The design professional and/or COTR must have unrestricted access to the stored materials during all business hours and may physically inventory all invoiced materials and equipment and may physically inspect the storage conditions.
 4. The Contractor must maintain and must provide the design professional and/or COTR, upon request, a current log of stored materials and equipment, which reflects when materials and equipment are used or added.
 5. The Contractor must obtain and maintain all risk property insurance at replacement cost, with the Veterans Administration listed as loss payee on all materials and equipment stored off-site and in transit.
- E. Notify Contracting Officer in writing, 60 days in advance, of date on which Contractor will be prepared to receive equipment furnished by Government. Arrangements will then be made by the Government for delivery of equipment.
1. Immediately upon delivery of equipment, Contractor shall arrange for a joint inspection thereof with a representative of the Government. At such time the Contractor shall acknowledge receipt of equipment described, make notations, and immediately furnish the Government representative with a written statement as to its condition or shortages.
 2. Contractor thereafter is responsible for such equipment until such time as acceptance of contract work is made by the Government.
- F. Contractor shall be responsible for and provide transport of Government-furnished equipment from off-site storage location to project site at time of installation.
- G. Equipment furnished by the Government will be delivered in a partially assembled (knock down) condition in accordance with existing standard commercial practices, complete with all fittings, fastenings, and appliances necessary for connections to respective services installed under contract. All fittings and appliances (i.e., couplings, ells, tees, nipples, piping, conduits, cables, and the like) necessary to make the connection between the Government furnished equipment item and the utility stub-up shall be furnished and installed by the contractor at no additional cost to the Government.
- H. Completely assemble and install the Government furnished equipment in place ready for proper operation in accordance with specifications and drawings.

- I. Furnish supervision of installation of equipment at construction site by qualified factory trained technicians regularly employed by the equipment manufacturer.

1.24 RELOCATED EQUIPMENT, ITEMS

- A. Suitably cap existing service lines, such as steam, condensate return, water, drain, gas, air, vacuum and/or electrical, whenever such lines are disconnected from equipment to be relocated. Remove abandoned lines in finished areas and cap as specified herein before under paragraph "Abandoned Lines".
- B. Provide all mechanical and electrical service connections, fittings, fastenings and any other materials necessary for assembly and installation of relocated equipment; and leave such equipment in proper operating condition.
- C. All service lines such as noted above for relocated equipment shall be in place at point of relocation ready for use before any existing equipment is disconnected. Make relocated existing equipment ready for operation or use immediately after reinstallation.

1.25 STORAGE SPACE FOR DEPARTMENT OF VETERANS AFFAIRS EQUIPMENT - NOT USED

1.26 GOVERNMENT-FURNISHED AND GOVERNMENT-INSTALLED ITEMS

- A. The Government shall deliver and install furniture and equipment as indicated in the Contract Documents.
- B. The Contractor shall be prepared to coordinate with the Government's personnel regarding delivery and installation of Government-Furnished and Government-Installed items.
 - 1. Open lines of communication between Contractor, Government, and the Government's vendor shall be established for the duration of the project.
 - 2. Contractor shall grant access to the construction site as required for delivery and installation of equipment.
- C. The Contractor shall advise the COTR in advance of any construction activities that will temporarily block access to rooms or portions of the project site.

1.27 SAFETY SIGNS

- A. Install all signs necessary to comply with OSHA, and other applicable regulations.
- B. Provide safeguards, including warning signs, barricades, warning lights, and other similar items as required for protection of all personnel during demolition, removal, and installation operations.
- C. Maintain signage and remove sign(s) when directed by the

COTR. 1.28 CONSTRUCTION DIGITAL IMAGES - NOT USED

1.29 FINAL ELEVATION DIGITAL IMAGES - NOT USED

1.30 HISTORIC PRESERVATION

Where the Contractor or any of the Contractor's employees, prior to, or during the construction work, are advised of or discover any possible archeological, historical and/or cultural resources, the Contractor shall immediately notify the COTR verbally, and then with a written follow up.

1.31 TOUR OF DUTY

- A. All work shall be performed during normal Medical Center duty hours, Monday through Friday, 8:00 am to 4:30 pm, excluding federal holidays, except as follows:
1. Work that requires systems to be shut down may be required to be performed during other than normal working hours, including early mornings, evenings, nights, weekends, and/or holidays. All utility shutdowns shall occur only after approval is given by the COTR.
 2. Work that interferes with normal VA functions shall be accomplished during other than normal working hours at a time least inconvenient to the hospital operations. This may include early mornings, evenings, nights, weekends, and/or holidays.
 3. The contractor may request to work other than normal duty hours with the approval of the COTR only. Request to work other than normal duty hours must be submitted to the COTR in writing. Approval or rejection of such requests will depend on the convenience to the Government.

1.32 LOCKOUT/TAGOUT POLICY:

The Contractor shall observe and comply with the Medical Center's lockout/tagout policy. As a minimum every affected person shall apply its own lock(s) on every point of potential energy such that every effected person is protected from all potential sources of energy by its own lock. Each lock shall be permanently identified to each affected person. The key for each affected person's lock shall remain solely with the effected person. No one other than the effected person may remove its lock. All affected persons shall remove their locks prior to leaving the Medical Center. If a person leaves the Medical Center without removing its lock(s), then that person will be required to return to the Medical Center and remove its lock(s) at no cost to the Government. If the affected person is not available, then the lock(s) shall be removed in accordance with the Medical Center's lockout/tagout policy at no cost to the Government. A copy of this policy is available from the COTR upon request.

1.33 COMPLIANCE WITH CODES AND REGULATIONS

All work shall be conducted and all materials handled in accordance with all codes including, but not limited to, the Occupational Safety and Health Act (29 CFR 1926), 29CFR 1910, NFPA Life Safety Code 101, 2009 ed., the NFPA National Electrical Code 70, 2008 ed., the NFPA Electrical Safety Code 70E, 2009 ed., the International Building Code, 2006 ed., the Uniform Federal Accessibility Standards, latest edition, and the Environmental Protection Act, latest edition.

1.34 MATERIAL SAFETY AND HEALTH CONSIDERATIONS

The following considerations are applicable to ALL Specification Sections:

The intent of this specification is to provide materials, adhesives and solvents, which are safe and environmentally responsible products. All materials, adhesives, solvents, and coatings shall be formulated to conform to the most stringent ecological, air quality, toxicity, flammability, and safety regulations in the event of any conflict herein. Provide low "Volatile Organic Compound: (VOC) compliant materials, adhesives, and solvents of quality and performance as specified. Out gassing materials, known or suspected carcinogens, and allergenics (i.e. formaldehyde, lead, zinc chromate) or otherwise longterm health threatening materials are to be avoided whenever possible. Provide material safety data sheets with submittals for review. Inform the COTR and Architect-Engineer of any suspect materials.

1.35 SUPERINTENDENCE BY THE CONTRACTOR

- A. At all times during the performance of this contract and until the work is completed and accepted in writing, the Contractor shall directly superintend the work or assign and have on the work a competent superintendent employed directly by the prime contractor who is satisfactory to the Contracting Officer and has legal authority to act for the Contractor.
- B. The Contractor shall furnish to the COTR each day a consolidated report for the preceding work day in which is shown the weather, number of laborers, mechanics, foremen/forewomen and pieces of heavy equipment used or employed by the Contractor and all subcontractors. The report shall bear the name of the firm, the branch of work which they perform such as concrete, plastering, masonry, plumbing, sheet metal work, and other such work. The report shall give breakdown of employees by crafts, location where employed, and work performed.
- C. At least weekly, the Contractor's Project manager, (a person designated by the Contractor to legally represent the Contractor to the Government) shall attend a meeting with the Contracting Officer and/or the

Contracting officer's Technical Representative for direct communications among all parties.

- D. Nothing contained in this contract shall be construed as creating any contractual relationship between and subcontractor and the Government. Divisions or section of specifications are not intended to control the Contractor in dividing work among subcontractors, or to limit work performed by any trade.
- E. The contractor shall be responsible to the Government for acts and omissions of his/her own employees and subcontractors and their employees. The Contractor shall also be responsible for coordination of the work of the trades, subcontractors, and material suppliers. The Contractor shall, in advance of the work, prepare coordination drawings showing the location of openings through slabs or walls, the pipe sleeves and hanger inserts, as well as the location and elevation of utility lines, including, but not limited to , conveyor systems, pneumatic tubes, ducts, and conduits and pipes 50 mm (2 inches) and larger in diameter. These drawings including plans, elevations, and sections as appropriate shall clearly show the manner in which the utilities fit into the available space and how they relate to each other and to existing building elements. Drawings shall be of appropriate scale to satisfy the previously stated purposes, but not smaller than 9mm (3/8) scale. Drawings may be composite (with distinctive colors for the various trades) or may be separated but fully coordinated drawings (such as sepias or photographic paper reproducible) of the same scale. Separate drawings shall depict identical building areas or sections and shall be capable of being overlaid in any combination. The submitted drawings for a given area of the project shall show the work of all trades which will be involved in that particular area. Six complete composite drawings or six complete sets of separate reproducible drawings shall be received by the Government not less than 20 days prior to the scheduled start of the work in the area illustrated by the drawings, for the purpose of showing the contractor's planned method of installation. The objective of such drawings are to promote carefully planned work sequence and proper trade coordination, in order to assure the expeditious solutions of problems and the installation of lines and equipment as contemplated by the contract documents while avoiding or minimizing additional costs to the contractor and to the Government. In the event the contractor, in coordinating the various installations and in planning the method of installation, finds a conflict in location or elevation of any of the utilities with themselves, with structural items or with other construction items, the contractor shall bring this

conflict to the attention of the Contracting Officer immediately. In doing so, the Contractor shall explain the proposed method of solve in the problem or shall request instruction as to how to proceed if adjustments beyond those of usual trades' coordination are necessary. Utilities installation work will not proceed in any area prior to the submission and completion of the Government review of the coordinated drawings for that area, nor in any area in which conflicts are disclosed by the coordination drawings until the conflicts have been corrected to the satisfaction of the Contracting Officer. It is the responsibility of the contractor to submit the required drawings in a timely manner consistent with the requirements to complete the work covered by this contract within the prescribed contract time.

- F. The Government or its representatives will not undertake to settle any differences between the contractor and subcontractors or between subcontractors.

1.36 MATERIAL AND WORKMANSHIP

- A. All equipment, material, and articles incorporated into the work covered by this contract shall be new and of the most suitable grade for the purpose intended, unless otherwise specifically provided in this contract. References in the specifications to equipment, material, articles, or patented processes by trade name, make, or catalog number, shall be regarded as establishing a standard of quality and shall not be construed as limiting competition. The Contractor may, at its option, use any equipment, materials, article, or process that, in the judgment of the Contracting Officer, is equivalent to that named in the specifications, unless otherwise specifically provided in this contract.
- B. The Contractor shall obtain the Contracting Officer's approval of the machinery and mechanical and other equipment to be incorporated into the work. When requesting approval, the Contractor shall furnish to the Contracting Officer the name of the manufacturer, the model number, and other information concerning the performance, capacity, nature, and rating of the machinery and mechanical and other equipment. When required by this contract or by the Contracting Officer, the Contractor shall also obtain the Contracting Officer's approval of the material or articles which the Contractor contemplates incorporating into the work. When requesting approval, the Contractor shall provide full information concerning the material or articles. When directed to do so the Contractor shall submit samples for approval at the contractor's expense, with all shipping charges prepaid. Machinery, equipment, material, and articles that do not have the required approval shall be installed or used at the risk of subsequent rejection.

C. All work under this contact shall be performed in a skillful and workman like manner. The Contracting Officer may require, in writing, that the Contractor remove from the work any employee the Contracting Officer deems incompetent, careless, or otherwise objectionable.

1.37 UNKNOWN ASBESTOS

The Contractor shall notify all workers that unknown asbestos could be encountered that has not been previously identified in the Contract Documents. In the event a suspect asbestos containing material is encountered during the construction, the Contractor shall immediately vacate the area and contact the COTR before proceeding further for appropriate testing and abatement procedures.

1.38 INSPECTIONS

The Government shall perform periodic inspections during the construction. These inspections are for the sole benefit of the Government and in no way relieve the Contractor of the responsibility of maintaining an adequate inspection and quality control system. The Government will conduct a final inspection and may conduct other inspections during which a punch list is generated (i. e. above ceiling inspection, roof inspection, exterior inspection, etc.). The Contractor shall notify the Contracting Officer, in writing when it will be ready for a government inspection. The Contractor is required to have all work to be inspected completed prior to a Government inspection. Prior to the final inspection, the Contractor may request a pre-final inspection be conducted by the Government. Provided the Government has adequate time, the project COTR will walk thru the project with the Contractor and point out items that need completion or correction. The Contractor will be responsible for taking notes or marking items during this walk thru. Prior to the final inspection for a given project or phase, the contractor is require to have all work required by the contract for the project or phase completed. During the final inspection, a punch list of correction items will be generated. It typically requires 2-3 days following the final inspection before a punch list is available. Final payment will not be made until all punch list items and all other technical and commercial requirements are met or properly corrected.

1.39 MODIFICATIONS DUE TO EQUIPMENT CHANGES

The project has been designed around specific equipment as listed in the equipment schedules. This is not meant to limit the equipment to be used on the project. It is a necessity of design. Other equipment is permitted to be used, provided it meets the requirement to be equal to the equipment designed around. However, the contractor is responsible

for determining if using a different piece of equipment will require changes in the design. The Contractor is responsible for affecting any necessary changes for any and all costs related to changes necessitated by using different equipment than that design around.

1.40 PROJECT CALENDER DAY SCHEDULE

- A. Notice to proceed to substantial completion: 440 calendar days
 - Phase I: 40 calendar days for submittals & material gathering
 - Phase II: 400 calendar days for physical construction

1.41 MINIMUM CLEANLINESS OF TURNOVER OF AREA

DESCRIPTION OF SERVICES:

The Contractor shall provide all management, tools, equipment, supplies, materials, and labor necessary to ensure custodial services are performed.

- A. Hard Floors: All floors, except carpeted areas, shall be swept, dust mopped, damp mopped, wet mopped, and waxed (floor finish), to ensure they have a uniform, glossy appearance and are free of dirt, debris, dust, scuff marks, heel marks, other stains, and discoloration, and other foreign matter. Mondo Floors shall be scuff free and a floor finish called Taski Vision Matte shall be applied to the surface to present a Matte Shine. Vinyl Composite Tile floors shall be scuff free and a floor finish called Spartan IShine applied to the surface to present a glossy appearance.
- B. Vacuum Carpets: Vacuum carpeted areas. After vacuuming, the areas shall be free of all visible dirt, debris, litter and other foreign matter. Any spots shall be removed by carpet manufacturer's approved methods as soon as noticed.
- C. Clean Interior Glass/Mirrors: Clean all interior glass, including glass doors, partitions, walls, display cases, directory boards, windbreaks at entrances, mirrors, etc. After glass cleaning, there shall be no traces of film, dirt, smudges, water or other foreign matter. All adjacent sills, frames, ledges, etc. shall be cleaned.
- D. Clean Drinking Fountains: Clean and disinfect all porcelain and polished metal surfaces, including the orifices and drains, as well as exterior surfaces of fountains. Drinking fountains shall be free of streaks, stains, spots, smudges, scale and other obvious soil.
- E. General Dusting: All horizontal surfaces from eight (8) feet to twenty (20) feet above the floor level must be dusted or cleaned to eliminate dust collection, to include window blinds. Typewriters, copier machines, and equipment of similar nature shall not be dusted. Surfaces eight (8) feet and below are included in "Low Dust". Surfaces above eight (8) feet to twenty (20) feet are included in "High Dust".
- F. Clean and Disinfect: Completely clean and disinfect all surfaces of sinks, toilet bowls, urinals, lavatories, showers, shower mats,

dispensers, mirrors, plumbing fixtures, saunas, partitions, doors, walls and other such surfaces, using a germicidal detergent. After cleaning, surfaces will be free of deposits, dirt, streaks, stains, scale, scum and odors. Disinfect all surfaces of partitions, stalls, stall doors, entry doors, (including handles, kick plates, ventilation grates, metal guards, etc.), and wall areas adjacent to wall mounted lavatories, urinals, and toilets.

1.42 GREEN BUILDINGS ACTION PLAN

A. Quality Guidelines for Occupied Buildings under Construction, 1995.

After construction and prior to occupancy, conduct a minimum 72-hour flush-out with maximum outdoor air consistent with achieving relative humidity no greater than 60 percent. After occupancy, continue flush-out as necessary to minimize exposure to contaminants from new building materials.

B. Environmental Impact Measures

1. Low-Emitting Materials: Specify materials and products with low pollutant emissions, including adhesives, sealants, paints, carpet systems and furnishings.
2. Recycled Content: For EPA-designated products, use products meeting or exceeding EPA's recycled content recommendations. For other products, use materials with recycled content such that the sum of post-consumer recycled content plus one-half of the pre-consumer content constitutes at least 10 percent (based on cost) of the total value of the materials in the project.
3. Bio-based Content: For USDA-designated products, use products meeting or exceeding USDA's bio-based content recommendations. For other products, use bio-based products made from rapidly renewable resources and certified sustainable wood products.
4. Construction Waste: During a project's planning stage, identify local recycling and salvage operations that could process site related waste. Program the design to recycle or salvage at least 50 percent construction, demolition and land clearing waste, excluding soil, where markets or on-site recycling opportunities exist.
5. Ozone Depleting Substances: Eliminate the use ozone depleting substances during and after construction where alternative environmentally preferable products are available, consistent with either the Montreal Protocol and Title VI of the Clean Air Act Amendments of 1990 or equivalent overall air quality benefits that take into account life cycle impacts.

1.43 CONSTRUCTION SCOPE OF WORK

1. The Contractor shall provide construction period services to include all tools, labor, materials, and supervision to including all structural, architectural, interior design, civil, landscape, fire protection, mechanical, electrical work, and other disciplines necessary for Project 531-319, Construct New Community Living Center, at VA Medical Center, Boise, Idaho. Construction shall include any testing/inspections required to provide a complete project. Costs for these services shall be included in the fee proposal complete Build proposal.
2. The Government will provide approved drawings and specifications that will be the basis for the completing the project. The contractor shall meet with key VA staff at appropriate points throughout the construction process. The contractor shall visit the site, as required, to obtain details or specifics required for this project.
3. Project 531-319 is a construction project for new stand alone facility to house 3 Ea Community Living Center Home operations. Site contains 2 Ea buildings, first building is a single story Home, approximately 8960 Square Feet, second building is a 2 story home(s), approximately 15660 Square Feet. The new VA CLC design approach followed guidance known as " Green House ® " or " Small House " models. Houses are developed in 10 to 12 private room/bath rooms in a residential feel and setting.
4. All work shall be phased to limit disruptions and allow access to the buildings. The contractor is to provide the VA with a project schedule and schedule of values for the project.
5. The project construction shall be completed in accordance with this Scope of Work, Project Drawings, and all appropriate Department of Veterans Affairs (VA) standards, specifications, and other criteria unless otherwise approved by VA. Approved Specifications are provided. The following references, as a minimum, shall be utilized for construction purposes. The current version of each dated prior to the contract award will be used. The majority of these items are available on the Internet at <http://www.cfm.va.gov/til/>
 - a. Master Construction Specifications PG-18-1
 - b. Design & Construction Procedures PG-18-3
 - c. Environmental Compliance Manual PG-18-17
6. Performance Period of construction contract is 14 Months, 15 Days
7. The Following items are to be provided at the completion of the project.
 - a. One set prints reflecting as-built conditions stamped "As-Built"

8. Construction RFI's shall be sent to the Contracting Officer. The COTR will review and comment back.
9. Daily logs shall be sent to the VA COTR the following morning.
10. Invoices will be sent to the VA COTR. The VA will confirm the percent complete and send acceptance confirmation to the contractor, allowing invoice to be Faxed to OLCS Austin payment center for processing.
11. During construction the VA COTR will be the primary point of contact for the contractor.
12. The contractor will provide all materials, equipment, and personnel necessary to accomplish the construction as outlined. Work will involve, but will not be limited to, demolition, excavation, plumbing, underground utilities, and all other work required for project completion.
13. Contractor's work and responsibility shall include all Contractor planning, programming, administration, and management necessary to provide all construction and related services as required. The Contractor shall conduct the work in strict accordance with the contract and all applicable Federal, State, and local laws, regulations, codes, or directives. All work under this contract shall be performed in a skillful and workmanlike manner. The Contractor shall insure that all work provided meets, or exceeds the scope of work, the project plans, and the contract specifications.
14. The Contractor shall perform any or all functions identified in the contract during normal working hours 8:00AM to 4:30PM, Monday through Friday, excluding federal holidays, unless the Contractor requests and is authorized to work a different shift or the nature of the work requires that the work be accomplished at other than normal duty hours.
15. The Contractor shall provide VA with the telephone number at which the Contractor or his representative may be contacted at any time during regular working hours and an emergency number at which the Contractor may be contacted in situations requiring immediate attention. The above-mentioned representative must have full power and authority to act upon the behalf of the Contractor.
16. Supervision. The VA will not exercise any supervision or control over the contractor's employees performing services under this contract. Such employees shall not be accountable to the VA, but solely to the Contractor, who, in turn, is responsible to the VA. At all times during the performance of this project the Contractor shall directly oversee the work, or assign, and have on the work site, a competent representative who is satisfactory to the VA and has authority to act

- for the Contractor. This may include a working supervisor.
17. Progress meetings shall be held between the Contractor and the VA, to discuss work progress, problems, and potential modifications.
 18. Before commencement of work, the Contractor shall confer with the VA COTR and agree on a sequence of procedures; means of access to premises and building; space for storage of materials and equipment; delivery of materials and use of approaches, location of eating spaces, and restrooms for Contractor employees. Delivery of materials and equipment shall be made with a minimum of interference to Government operations and personnel.
 19. The contractor shall comply with all EPA, OSHA, and VA criteria. This includes GEMS requirements and Infection Control requirements.
 20. The Contractor shall take all precautions to ensure that no damage will result from operations to private or public property. All damages shall be repaired or replaced by the Contractor at no cost to the Government.
 21. The Contractor shall be responsible for providing all work site protective barriers and site control devices. This includes, but is not limited to: protective fences; protective tapes; and protective signage. The Contractor shall be responsible for providing all necessary traffic control, such as, street blockages, traffic cones, flagman, etc., as required, at no additional cost to the VA. No street shall be completely closed to traffic without prior approval from the Contracting Officer's representative.
 22. At the beginning of the project, the Contractor shall sign in at Building 50 to obtain visitors badges.
 23. The movement of Contractor personnel, equipment, materials, and tools shall be confined to approved staging area(s) so as not to interfere with ongoing operations in the work areas. All temporary outages of any utility services required for the performance of work shall be scheduled with the COTR no less than five (5) workdays in advance of such outages. Major outages may require additional lead time.
 24. The Contractor's Quality Control (CQC) Plan, with which the Contractor proposes to implement the requirements of FAR Clause 52.246-1 2, entitled "Inspection of Construction", shall identify personnel, procedures, instructions, records, and forms to be used.
 25. Testing Procedures: The Contractor shall perform tests specified or required to verify control measures are adequate to provide a product which conforms to contract requirements and required submittals. The Contractor shall procure the services of industry recognized testing laboratory or establish an approved testing laboratory at the project site.

1.44 RESPONSIBILITY FOR COMPLETION

- A. Whenever it becomes apparent from the current monthly progress review meeting or the monthly computer-produced calendar-dated schedule that phasing or contract completion dates will not be met, the Contractor shall execute some or all of the following remedial actions:
1. Increase construction manpower in such quantities and crafts as necessary to eliminate the backlog of work.
 2. Increase the number of working hours per shift, shifts per working day, working days per week, the amount of construction equipment, or any combination of the foregoing to eliminate the backlog of work.
 3. Reschedule the work in conformance with the specification requirements.
- B. Prior to proceeding with any of the above actions, the Contractor shall notify and obtain approval from the Contracting Officer for the proposed schedule changes. If such actions are approved, the CPM revisions shall be incorporated by the Contractor into the network diagram before the next update, at no additional cost to the Government.

1.45 CHANGES TO NETWORK DIAGRAM AND SCHEDULE

- A. Within 30 calendar days after VA acceptance and approval of any updated computer-produced schedule, the Contractor will submit a revised network diagram, the associated compact disk(s), and a list of any activity/event changes including predecessors and successors for any of the following reasons:
1. Delay in completion of any activity/event or group of activities/events, indicate an extension of the project completion by 20 working days or 10 percent of the remaining project duration, whichever is less. Such delays which may be involved with contract changes, strikes, unusual weather, and other delays will not relieve the Contractor from the requirements specified unless the conditions are shown on the CPM as the direct cause for delaying the project beyond the acceptable limits.
 2. Delays in submittals, or deliveries, or work stoppage are encountered which make rescheduling of the work necessary.
 3. The schedule does not represent the actual prosecution and progress of the project.

4. When there is, or has been, a substantial revision to the activity/event costs of the network diagram regardless of the cause for these revisions.

- B. CPM revisions made under this paragraph which affect the previously approved computer-produced schedules for Government furnished equipment, vacating of areas by the VA Medical Center, contract phase(s) and sub phase(s), utilities furnished by the Government to the Contractor, or any other previously contracted item, must be furnished in writing to the Contracting Officer for approval.
- C. Contracting Officer's approval for the revised network diagram and all relevant data is contingent upon compliance with all other paragraphs of this section and any other previous agreements by the Contracting Officer or the VA representative.
- D. The cost of revisions to the network diagram resulting from contract changes will be included in the proposal for changes in work as specified in Article, FAR 52.243 -4 (CHANGES), VAAR 852.236 - 88 (CHANGES - SUPPLEMENTS), and will be based on the complexity of the revision or contract change, man hours expended in analyzing the change, and the total cost of the change.
- E. The cost of revisions to the network diagram not resulting from contract changes is the responsibility of the Contractor.

1.46 ADJUSTMENT OF CONTRACT COMPLETION

- A. The contract completion time will be adjusted only for causes specified in this contract. Request for an extension of the contract completion date by the Contractor shall be supported with a justification, CPM data and supporting evidence as the Contracting Officer may deem necessary for determination as to whether or not the Contractor is entitled to an extension of time under the provisions of the contract. Submission of proof based on revised activity/event logic, durations (in work days) and costs is obligatory to any approvals. The schedule must clearly display that the Contractor has used, in full, all the float time available for the work involved in this request. The Contracting Officer's determination as to the total number of days of contract extension will be based upon the current computer-produced calendar-dated schedule for the time period in question and all other relevant information.
- B. Actual delays in activities/events which, according to the computer-produced calendar-dated schedule, do not affect the extended

and predicted contract completion dates shown by the critical path in the network, will not be the basis for a change to the contract completion date. The Contracting Officer will within a reasonable time after receipt of such justification and supporting evidence, review the facts and advise the Contractor in writing of the Contracting Officer's decision.

- C. The Contractor shall submit each request for a change in the contract completion date to the Contracting Officer in accordance with the provisions specified under Article, FAR 52.243 -4 (CHANGES), VAAR 852.236 - 88 (CHANGES - SUPPLEMENTS). The Contractor shall include, as a part of each change order proposal, a sketch showing all CPM logic revisions, duration (in work days) changes, and cost changes, for work in question and its relationship to other activities on the approved network diagram.
- D. All delays due to non-work activities/events such as RFI's, WEATHER, STRIKES, and similar non-work activities/events shall be analyzed on a month by month basis.

1.47 CONSTRUCTION SCHEDULE RISK ANALYSIS / MITIGATION PLAN

- A. Schedule Risk Analysis - The contractor shall conduct the statistical schedule risk analysis based on the above detailed construction activities in the Day 1 approved diagram, identifying major schedule risk areas and recommended risk mitigation plans as outlined below.
- B. The risk analysis shall be conducted by a person or firm skilled in the statistical method of schedule risk analysis based on the (PDM) network techniques for major construction projects, preferably in the major health care related projects. The cost of this service shall be included in the Contractor's proposal.
- C. The Contracting Officer has the right to approve or disapprove the Person or firm designated to perform the risk analysis.

1.48 RISK ANALYSIS FORMAT / REQUIREMENTS / SUBMITTALS

- A. Risk Analysis Software / Format - Within 45 calendar days (60 calendar days on projects over \$50,000,000) after receipt of Notice to Proceed, the Contractor shall submit for the Contracting Officer's review; a Risk Analysis software to be utilized, the method of performing the analysis, the format of presenting the data and the reports for VA approval.
- B. Conduct Risk Analysis / Submittals - **Based on the approved software / format, the consultant shall perform statistical risk analysis on the**

detailed approved Day 1 diagram. The contractor shall review and utilize any previous Risk analysis performed by the A/E of record based on the "semi-detailed" (yet at an overall level) construction logic and schedule to ensure the continuity of previous schedule risk analysis. The contractor's project manager and Superintendent shall identify the major schedule risk areas and possible risk mitigation strategy/plan and record it in a narrative format, with **electronic file submission** to the VA. **The risk analysis exercise shall be performed or updated at least on a quarterly basis or as directed by the VA Contracting officer.**

- C. The submittal shall include three copies of a computer-produced risk analysis results, predicting the various meaningful probability curves of achieving the contract schedules. It shall also include a detailed narrative list of all major and minor potential and specific schedule and cost risk areas, and a contractor's recommendations of mitigating the identified risks which must be addressed by the VA Project and Resident engineer teams to maintain the contract schedule.

- - - E N D - - -

PERMIT
FOR CUTTING AND WELDING
WITH PORTABLE GAS OR ARC EQUIPMENT

VA Project Number: _____

Name of Contractor: _____

Date: _____

Building/Location: _____

Work To Be Done: _____

Special Precautions: _____

Fire Watch Required: Yes No

The location where this work is to be performed has been examined, necessary precautions have been taken, and permission is granted for this work. (See Page A2).

Date Permit Expires: _____

Signed _____
(Contractor's individual responsible for authorizing hot work)

Time Hot Work Started: _____ Time Hot Work Completed: _____

FINAL CHECK-UP

Work area and all adjacent areas to which sparks and heat might have spread (including floors above and below and on opposite sides of walls) were inspected 30 minutes after the work was completed and were found firesafe.

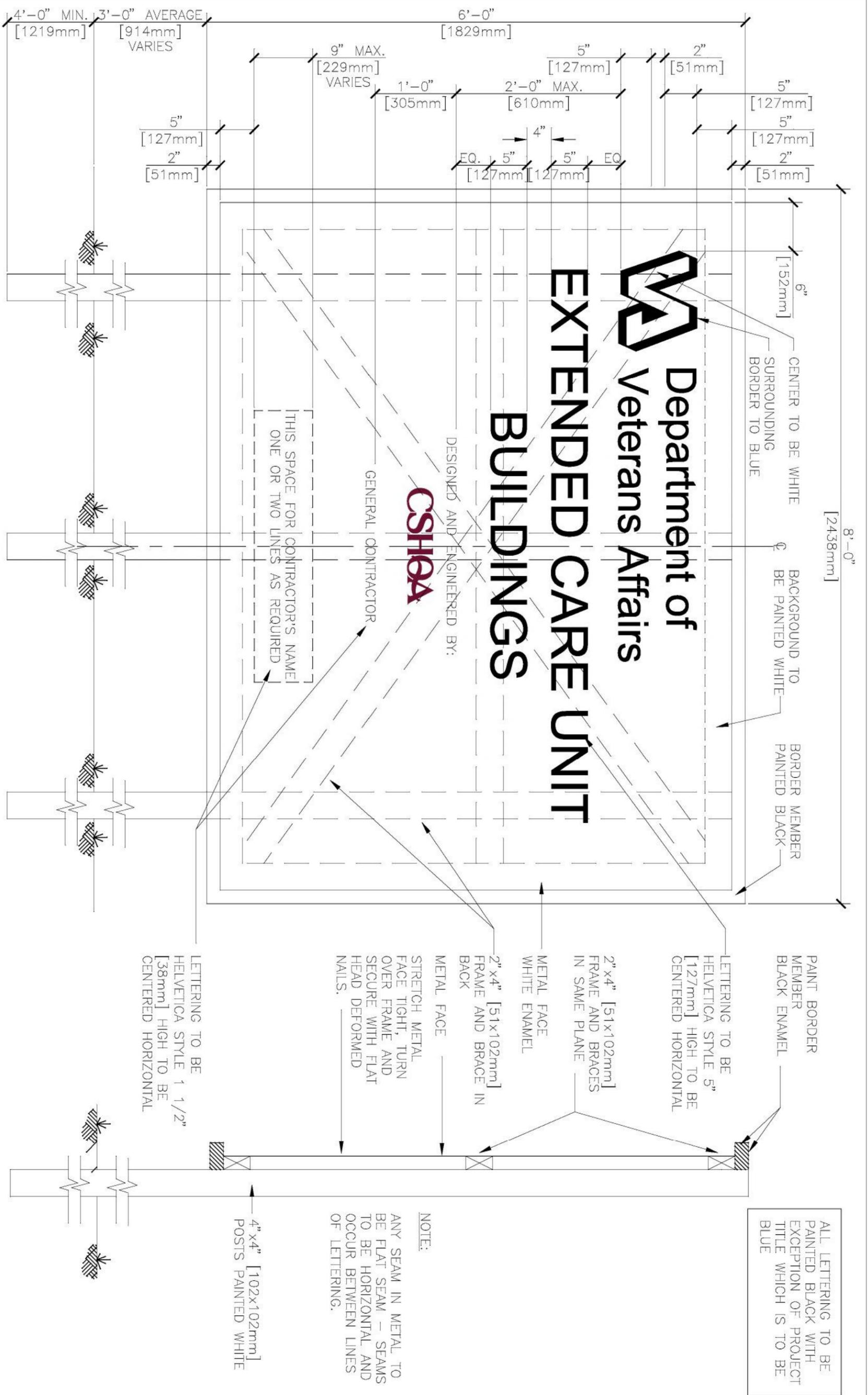
Signed _____
(Contractor's Fire Watch)

ATTENTION

Before approving any cutting and welding permit, the contractor's authorized representative or their appointee shall inspect the work area and confirm that precautions have been taken to prevent fire in accordance with NFPA Standard No. 51B.

PRECAUTIONS

- o Sprinklers are in service where installed
- o Cutting and welding equipment in good repair
- o Within 10.67 meters (35 feet); floors swept clean of combustible, no combustible material or flammable liquids, all wall and floor openings covered, and covers suspended beneath work to collect sparks
- o When working on enclosed equipment and in confined space, equipment and area is free of flammable vapors
- o Fire watch provided during and 30 minutes after operation (60 minutes for torch applied roofing operations)
- o Portable fire extinguisher with adequate rating available in the immediate vicinity
- o Standpipe system in service where installed
- o Protection of any sprinkler heads when hot work is in close proximity
- o Smoking prohibited in immediate area
- o Non-combustible shields provided when hot work is done near combustible walls, partitions, floors, and roofs
- o Prohibition of hot work on pipes contacting combustible walls
- o Personnel trained in use of equipment including portable fire extinguishers and sounding a fire alarm
- o Final check-up conducted after 30 minutes



ALL LETTERING TO BE PAINTED BLACK WITH EXCEPTION OF PROJECT TITLE WHICH IS TO BE BLUE

NOTE:
ANY SEAM IN METAL TO BE FLAT SEAM - SEAMS TO BE HORIZONTAL AND OCCUR BETWEEN LINES OF LETTERING.

DETAIL TITLE / CONSTRUCTION SIGN

SCALE : NONE

DATE ISSUED: DECEMBER 2008

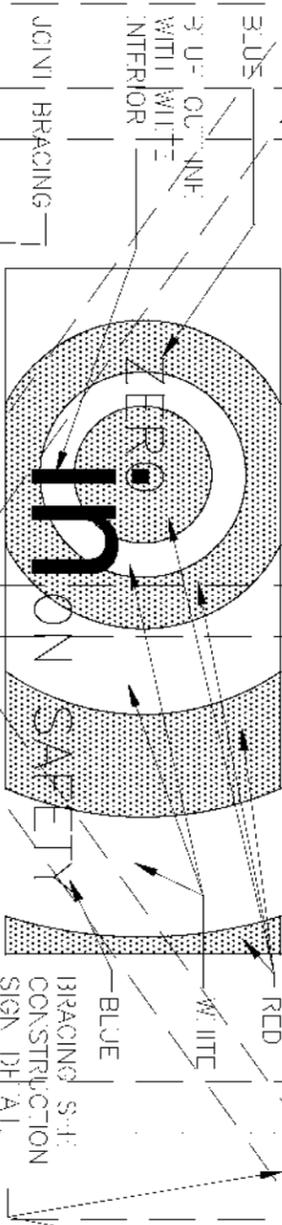
CAD DETAIL NO.: SD010000-1.DWG

CONSTRUCTION SIGN

2'-0"
[610mm]



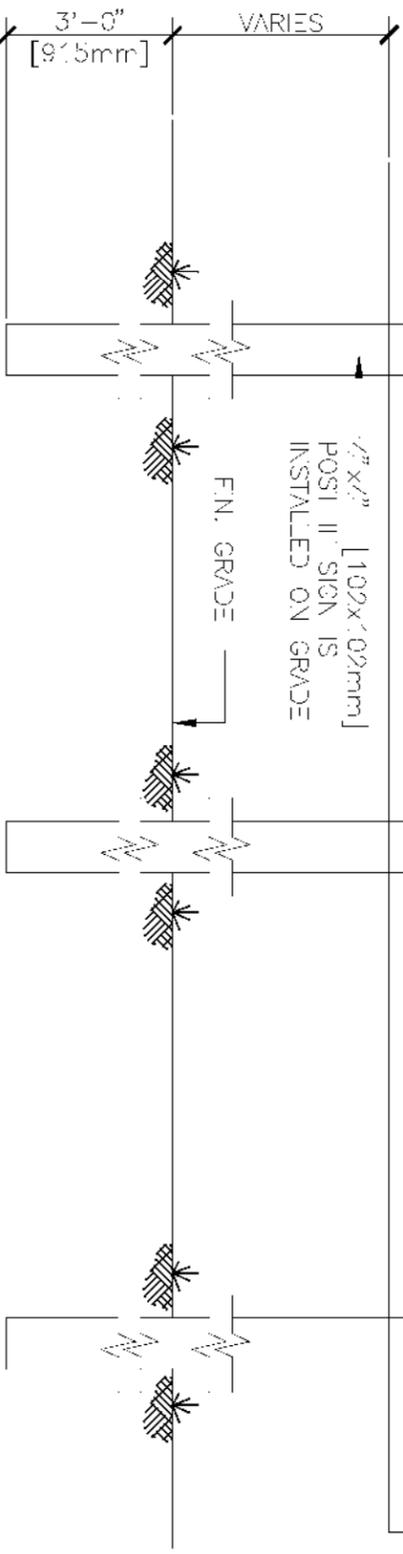
Department of Veterans Affairs



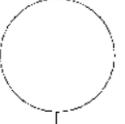
**THIS PROJECT
HAS WORKED
DAYS**

WITHOUT A LOST TIME ACCIDENT

CONTRACTOR'S NAME



ELEVATION



SAFETY SIGN

NTS

SECTION 01 01 50

OSHA REQUIREMENTS
SPECIFIC BOISE VETERANS AFFAIRS MEDICAL CENTER FIRE & SAFETY POLICIES,
PROCEDURES & REGULATIONS
SUBMITTALS & DEVIATIONS

PART 1 - OSHA REQUIREMENTS

1.1 GENERAL

- A. Contractor shall comply with Occupational Safety and Health Act of 1970. This will include the safety and health standards found in 29 CFR 1910 and 29 CFR 1926. Copies of these standards can be acquired from the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20420.
- B. In addition, Contractor is required to comply with other applicable Veterans Hospital Administration, Boise Veterans Affairs Medical Center, and Boise Facilities Management Service Regulations, Directives, Memorandums, and Policies. These documents are available in the Facilities Management Services Offices. Each of the Contractor's employees and sub-contractor's employees shall be required to read the statement of policies and regulations and sign an acknowledgement that such policies and regulations are understood. Signed acknowledgement will be returned to the COTR prior to any construction activity.
- C. Contractors involved with the removal, alteration, or disturbance of asbestos type insulation or materials will be required to comply strictly with the regulations found in 29 CFR 1010.1001 and the appropriate EPA regulations regarding disposal of asbestos. Assistance in identifying asbestos can be requested from the Medical Center's Industrial Hygienist and the COTR.
- D. Contractors entering locations of known asbestos contamination (i.e. pipe basements) shall be responsible for providing respiratory protection to their employees and ensuring respirators are worn in accordance with 29 CFR 1910.1001 (g). Asbestos contaminated areas shall be defined on the project drawings. The minimum equipment requirements shall be not less than minimum requirements by law or a half-mask air-purifying respirator equipped with high efficiency filters and disposable coveralls whichever is more protective.
- E. Contractor, along with other submittals, and at least two weeks prior to bringing any materials on-site, must submit a complete list of chemicals the Contractor will use and MSDS for all hazardous materials as defined

in 29 CFR 1910.1200 (d) Hazard Determination. Contracting Officer shall have final approval of all materials brought on site.

- F. The Contractor shall be held solely responsible for the safety and health of its employees, sub-contractor employees and any and all persons entering the Medical Center in relation to the Contractor's Work. The Contractor shall also be held responsible to protect the health and safety of the Veterans Affairs Community (including patients, visitors, staff, and other persons allowed on the Medical Center facility) from the unwanted efforts of construction. Veterans Affairs staff will monitor the Contractor's performance in complying with all safety and health aspects of the project. Severe, significant, repeat or constant violations may result in than immediate work stoppage or a request for an inspection of a Compliance officer from the Occupational Safety and Health Administration.
- G. During all phases of the project the Contractor is required to comply with and strictly follow NFPA 241 "Standard for Safeguarding Construction, Alteration and Demolition Operations". The Medical Center's Safety Officer, Occupational Health Specialist, Industrial Hygienist, Infection Prevention and Control Nurse, Contracting Officer and COTR will closely monitor the work area for compliance. Appropriate action will be taken for non-compliance up to and including contract termination for cause.

PART 2 - SPECIFIC BOISE VETERANS AFFAIRS MEDICAL CENTER FIRE & SAFETY POLICIES, PROCEDURES & REGULATIONS (SEE ALSO 01 00 00 GENERAL REQUIREMENTS) 2.1 INTRODUCTION

- A. The safety and fire protection of patients, employees, members of the public and government is of primary and continuous concern to this Medical Center.
- B. Contractors, their supervisors, subcontractors and their employees are required to comply with Medical Center Directives, Memorandums, and policies ensuring the occupational safety and health of all. Failure to comply with any provisions of any terms, limitations, restrictions or other portions of such policies may result in sanctions up to and including contract termination for cause.
- C. While working at the Boise Veterans Affairs Medical Center, Contractor and its subcontractors are responsible for the occupational safety and health of their employees. Contractor is required to comply with all applicable portions of 29 CFR 1910 and 29 CFR 1926 as appropriate. Failure to comply with any portion of these laws may result in work

stoppage and a request to the Area Director of OSHA for a Compliance Officer to inspect the work site.

- D. Contractors are to comply with requirements found in the National Fire Protection Association (NFPA) #241 "Building Construction and Demolition Operation" and NFPA #51B "Fire Prevention in Use of Cutting and Welding Processes".
- E. Questions regarding occupational safety and health issues can be addressed to the Contracting Officer. The Medical Center's Safety Officer, Occupational Health Specialist, Industrial Hygienist, or Infection Prevention and Control Nurse, will advise the Contracting Officer when requested.

2.2 PERSONNEL CONDUCT

- A. The Boise Veterans Affairs Medical Center is Federal Property and any person entering is subject to federal law enforcement.
- B. All personnel shall follow all safety regulations, violation of any of the regulations may result in immediate removal from VA property.
- C. There shall be NO SMOKING by contractor personnel on VA property; this prohibition includes all vehicles, contractor trailers, and anywhere else while on VA property.
- D. Personnel on site shall not engage in: gambling, horseplay of any sort, sales or offer to sell any goods or services, or any other action deemed not conducive to the proper operation of the Medical Center as determined by the Contracting Officer.
- E. Contractor personnel shall not bring onto the VA property: weapons, alcohol, animals, other personnel, family members unless employed by the Contractor, or other deleterious materials as determined by the Contracting Officer.
- F. The use of radios, I-Pods and other personal items on site is a privilege, which may be revoked at any time or for any reason by the COTR.
- G. Any form of sexual harassment may result in immediate expulsion from the Medical Center property and denial of re admittance as determined by the Contracting Officer.
- H. Contractor shall not allow any food to be brought into the construction area.

2.3 HAZARD COMMUNICATION

- A. Contractor shall comply with OSHA Standard 29CFR 1926.59 "Hazard Communication".

- B. Contractor shall submit to the Veterans Administration Industrial Hygienist, copies of the Material Safety Data Sheets covering all hazardous materials to which the Contractor and Medical Center employees, patients and visitors may be exposed.
- C. Copies of Material Safety Data Sheets covering all hazardous materials to be use by the Contractor shall be submitted to the COTR prior to bringing the material(s) on to the Medical Center property.
- D. Contractor shall inform the COTR of the hazards to which Medical Center personnel, patients and visitors may be exposed.
- E. Contractor shall have a written Hazard Communication Program available at the construction site at all times, which details how the Contractor shall comply with 29 CFR 1926.59.

2.4 BLOODBORNE PATHOGENS

- A. Since work will take place in a hospital, there is the possibility of the Contractor coming in contact with blood and body fluids whenever working on the sanitary sewer system, dental vacuum system and other utility systems as identified by the VA. The Contractor shall comply with 29 CFR 1910 Subpart Z Toxic and Hazardous Substances section 1910.1030 bloodborne pathogens for work on the affected utilities.

2.5 FIRES & FIRE NOTIFICATION

- A. All fires must be reported. In the event of a fire in the work area, use the nearest fire alarm pull station, and notify the Medical Center staff in the immediate area. All fire alarms are responded to by the Boise City Fire Department. Emergency notification can also be accomplished through Medical Center telephones by dialing 9-911. Be sure to give the exact location from where you are calling and the exact nature of the emergency. If the Contractor experiences a fire that was rapidly extinguished by the Contractor's forces, the Contractor must still notify the COTR within one hour of the event. Independent of any Contractor review, the Government shall conduct a detailed fire investigation.

2.6 INTERIM LIFE SAFETY MEASURES (ISLM)

- A. 14 days prior to any work impairing the life safety components or utilities of the Medical Center the Contractor shall notify in writing to the COTR the proposed portion of work and its duration. The life safety components include but are not limited to any portion of the means of egress as further defined in NFPA 101, the fire alarm notification system, the automatic fire sprinkler system, building fire

stand pipes, fire hydrants, and emergency access to the structure or construction site.

- B. The Contractor shall work with the Medical Center's safety officer and COTR in completing an ILSM checklist, and shall follow all requirements listed in the ILSM for the impairment. Under no circumstance is a Contractor allowed to deactivate any of the fire protection systems in this Medical Center.
- C. If the nature of the work requires the deactivation of the fire alarm, smoke detection or sprinkler system, you must notify the COTR. Notification must be made well in advance such that ample time can be allowed to deactivate the system and provide alternative measures for fire protection.
- D. False alarms will not be tolerated. Contractors are required to be familiar with the location of the smoke detectors in your work area. When performing cutting, burning or welding or any other operations that may cause smoke or dust, you must take steps to temporarily cover smoke detectors in order to prevent false alarms. Failure to take the appropriate action will result in the Contracting Officer assessing actual costs for government response for each false alarm that is preventable. Prior to covering the smoke detectors, the Contractor shall request an ILSM as further described above. The Contractor will notify the COTR when the impairment is initiated, and who will also be notified when the covers are removed.

2.7 HOT WORK PERMIT

- A. Hot work is defined as operations including, but not limited to, cutting, welding, thermal welding, brazing, soldering, grinding, thermal spraying, thawing pipes, or any similar situation. If such work is required, the Contractor must notify the COTR no less than one day in advance of such work. The general contractor will inspect the work area and issue a "Hot Work Permit" authorizing the performance of such work.
- B. All hot work will be performed in compliance with the Medical Center's policy regarding Hot Work Permits and NFPA 241, Safeguarding Construction, Alteration, and Demolition Operations, and NFPA 51B, Fire Prevention in Use of Cutting and Welding Processes, and applicable OSHA standard. A hot work permit will only be issued to individuals familiar with these regulations.
- C. A hot work permit will only be issued when the following conditions are met:

1. Combustible materials are located a minimum of 25 feet from the work site, or protected by flameproof covers or shielded with metal or fire-resistant guards or curtains.
 2. Openings or cracks in walls, floors, or ducts within 25 feet of the site are covered to prevent the passage of sparks to adjacent areas.
 3. Where cutting or welding is done near walls, partitions, ceiling, or roof of combustible construction, fire resistant guards or shields are provided to prevent ignition.
 4. Cutting or welding on pipes or other metal in contact with combustible walls, ceilings or roofs is not undertaken if the work is close enough to cause ignition by conduction.
 5. Fully charged and operable fire extinguishers, appropriate for the type of possible fire, are available at the work area.
 6. When cutting or welding is done in close proximity to a sprinkler head, a wet rag is laid over the head during operation.
 7. Assure that nearby personnel are protected against heat, sparks, cut off, etc.
 8. Assure that a fire watch is at the site. Make a final check-up 30 minutes after completion of operations to detect and extinguish any smoldering fires.
- D. A fire watch shall be provided by the Contractor whenever cutting, welding, or performing other hot work. Fire watcher(s) shall:
1. Have fire-extinguishing equipment readily available and be trained in its use.
 2. Be familiar with facilities and procedures for sounding an alarm in the event of fire.
 3. Watch for fires in all exposed areas, sound the fire alarm immediately, and try to extinguish only within the capability of the portable extinguishing equipment available. In all cases if a fire is detected the alarm shall be activated even if the fire is extinguished.
 4. Maintain the watch for at least a half-hour after completion of operations to detect and extinguish smoldering fires.
- E. A "Hot Work Permit" will be issued only for the period necessary to perform such work. In the event the time necessary will exceed one day, a "Hot Work Permit" may be issued for the period needed; however, the general contractor will inspect the area daily. Hot work permit will apply only to the location identified on the permit. If additional areas involve hot work, then additional permits must be requested.

F. Contractors will not be allowed to perform hot work processes without the appropriate permit.

- G. Any work involving the Medical Center's fire protection system will require COTR notification. Under no circumstances will the Contractor or employee attempt to alter or tamper with the existing fire protection system.
- H. The general contractor will be notified within 30 minutes of the completion of all hot work to perform an inspection of the area to confirm that sparks or drops of hot metal are not present.

2.8 TEMPORARY ENCLOSURES

Only non-combustible materials will be used to construct temporary enclosures or barriers at this Medical Center. Plastic barriers are normally prohibited unless specifically allowed by the Contracting Officer in writing. Plastic materials and fabrics used to construct dust barriers must conform to NFPA #701, Standard Methods of Fire Tests for Flame-Resistant Textiles and Films.

2.9 FLAMMABLE LIQUIDS

All flammable liquids will be kept in approved safety containers. Only the amount necessary for your immediate work will be allowed in the building. Flammable liquids must be removed from the building at the end of each day.

2.10 COMPRESSED GAS CYLINDERS

Compressed gas shall be secured in an upright position at all times. A suitable cylinder cart will be used to transport compressed gas cylinders. Only those compressed gas cylinders necessary for immediate work will be allowed in occupied buildings. All other compressed gas cylinders will be stored outside of buildings in a designated area. Contractor will comply with applicable standards compressed gas cylinders found in 29 CFR 1910 and 1926 (OSHA).

2.11 INTERNAL COMBUSTION ENGINE-POWERED EQUIPMENT

Equipment powered by an internal combustion engine such as saws, compressors, generators and etc. will not be used in an occupied building. Special consideration may be given for unoccupied buildings only if the OSHA and NFPA requirements have been met.

2.12 POWDER ACTIVATED TOOLS

The operator of powder activated tools must be trained and certified to use them. Powder activated tools will be kept in a secured manner at all times. When not in use, the tools will be locked up. When in use, the operator will have the tool under his immediate control.

2.13 PROJECT, WORK AREA AND TOOL SECURITY

- A. Under no circumstances are equipment, tools and other items of work to be left unattended for any reason. All tools, equipment and items of work must be under the immediate control of employees or subcontractors.
- B. If for some reason a work area must be left unattended, then it will be required that tools and other equipment be placed in an appropriate box or container and locked. All tool boxes, containers or any other device used for the storage of tool and equipment, will be provided with a latch and padlock. All tool boxes, containers or any other device used for the storage of tools and equipment, will be locked at all times except for putting in and removing tools.
- C. All doors, gates, and other accesses to work areas will be closed and locked when rooms or the work sites are left unattended. Failure to comply with this directive will be considered a violation of VA Regulations 1.218 (b), "Failure to comply with signs of a directive and restrictive nature posted for safety purposes," subject to a \$50.00 fine. Subsequent similar violations may result in both imposition of such a fine as well as the Contracting Officer taking action under the Contract's "Accident Prevention Clause" (FAR 52.236-13) to suspend all contract work until violations such may be satisfactorily resolved or under FAR 52.236-5 "Material and Workmanship Clause" to remove from the work site any personnel deemed by the Contracting Officer to be careless to the point of jeopardizing the welfare of Facility patients or staff.
- D. Contractor shall report to the VA Police Department, Ext. 1122, any tools or equipment that is missing.
- E. Tools and equipment found unattended will be confiscated and removed from the work area.

2.14 EQUIPMENT & MOTOR VEHICLE SAFETY

- A. Pedestrians have the Right-of-Way at all times whether in a crosswalk, or not.
- B. All vehicles shall strictly follow the posted speed limits. The VA police have the authority to issue citations for driving violations.
- C. All loads shall be properly secured and covered as appropriate prior to operation on the Medical Center grounds.
- D. Seat belts shall be worn by all drivers and passengers in vehicles any time the vehicle is in motion. When operating any motorized equipment equipped with or designed for a seat belt, its use shall be mandatory.
- E. Riders are prohibited from equipment unless specifically designed for their transportation.

- F. Mounting or dismounting a moving vehicle or equipment is strictly prohibited.
- G. Equipment shall only be used by properly trained employees following all manufacturers' instructions including all safety precautions. All equipment shall be maintained in good condition and without modification. Any damaged or altered equipment shall be immediately removed from the VA property.
- H. Fuel for equipment shall be stored on accordance with OSHA and NFPA requirements. Fueling of any piece of equipment shall take place a minimum of 50 feet away from any building or combustible material.
- I. The Contractor shall ensure all motorized equipment or vehicles shall be in proper working order with all required insurance, registrations, maintenance checks, and inspections up to date. All motorized vehicles and equipment shall only be operated by properly trained employees holding current and unrevoked credentials for the equipment or vehicle in question. The operator and any passengers al allowed shall follow all manufacturers' instructions including all safety precautions.
- J. The Government may require the cessation of use of motorized equipment due to noise, vibration, or odor and may require the Work to be performed at other than normal duty hours.

2.15 LADDERS

It is required that ladders not be left unattended in an upright position. Ladders must be attended at all times or taken down and chained securely to a stationary object. All non-self supporting ladders shall be lashed at the top. Fruit picker ladders are prohibited.

2.16 SCAFFOLDS

All scaffolds will be attended at all times. When not in use, an effective barricade (fence) will be erected around the scaffold to prevent use by unauthorized personnel. (Reference 29 CFR 1926. Subpart L)

2.17 EXCAVATIONS

The contractor shall comply with OSHA 1926 Subpart P. An OSHA "competent person" must be on site during the excavation. The contractor shall coordinate with the COTR and utility companies prior to the excavation to identify underground utilities tanks etc. All excavations left unattended will be provided with a barricade suitable to prevent entry by unauthorized persons. The barricade shall either be installed at least 6 feet from the edge of the excavation, or be capable of stopping a 200 lb lateral point load at the top of the barricade. Use of equipment as a barricade is not considered a sufficient barricade.

2.18 STORAGE

The Contractor shall make prior arrangements with the COTR for the storage of building materials. Storage will not be allowed to accumulate in the Medical Center buildings.

2.19 TRASH AND DEBRIS

The Contractor shall remove all trash and debris from the work area on a daily basis. Trash and debris will not be allowed to accumulate inside or outside of the buildings. Trash is specifically prohibited from being piled up on the ground, it must be placed in a suitable trash container. The Contractor is responsible for making arrangements for removal of trash from the Medical Center facility.

2.20 PROTECTION OF FLOORS

It may be necessary at times to take steps to protect floors from dirt, debris, paint, etc. A tarp or other protective covering may be used. However, you must maintain a certain amount of floor space for the safe passage of pedestrian traffic. Common sense must be used in this matter.

2.21 SIGNS

Signs must be placed at the entrance to work areas warning people of the work. Signs must be suitable for the condition of the work. Small pieces of paper with printing or writing are not acceptable. The VAMC Safety Officer can be consulted in this matter.

2.22 INFECTION CONTROL

All proposed work at the Medical Center shall be reviewed by the infection control coordinator to determine the required level of infection control necessary. The type of construction and patient risk group shall determine the level of infection control measures the Contractor shall be required to implement. The Medical Center's infection control coordinator's determination of the level of infection control shall be final. As a minimum, Contractor must control the generation of dust and the contamination of patient care surfaces, supplies and equipment. During demolition phases of the construction:

- A. The construction area shall be under negative pressure, ensuring there is an appreciable flow of clean air from the VA occupied portion of the facility into the construction area. The air flow shall be sufficiently strong to draw in the plastic door flaps commonly located at the construction entrance or at the specific site within the construction area;

- B. Construction debris being transported through the VA occupied portion of the facility shall be securely covered and whetted as necessary.
 - C. Construction employees shall remove dust-laden clothing before entering the VA occupied portion of the facility.
 - D. Sticky mats shall be placed at all construction entrances and satisfactorily maintained so as to minimize the tracking of dust into the VA occupied portion of the facility.
 - E. Dry sweeping of dust and debris is not to be performed.
- Additional requirements as determined by the infection control matrix as described in VAMC Directive 138-08-56 may be required of the Contractor. This work is specifically included in the Contractor's scope.

2.23 CONFINED SPACE ENTRY

- A. Contractor will be informed that the workplace contains permit required confined space and that permit space entry is allowed only through compliance with a permit space program meeting the requirements of 29 CFR 1910.146 and 1926.21 (b)(6).
- B. Contractor will be apprised of the elements including the hazards identified and the Medical Center's experience with the space that makes the space in question a permit space.
- C. Contractor will be apprised of any precautions or procedures that the Medical Center has implemented for the protection of employees in or near permit space where Contractor personnel will be working.
- D. Medical Center and Contractor will coordinate entry operations when both Medical Center personnel and Contractor personnel will be working in or near permit spaces as required by 29 CFR 1910.146 (d)(ii) and 1926.21 (b)(6).
- E. Contractor will obtain any available information regarding permit space hazards and entry operation from the Medical Center.
- F. At the conclusion of the entry operations the Medical Center and Contractor will discuss any hazards confronted or created in permit spaces.
- G. The Contractor is responsible for complying with 29 CFR 1910.246 (d) through (g) and 1926.21 (b)(6).

2.24 PERSONAL PROTECTIVE EQUIPMENT

As a minimum, the Contractor shall comply with all OSHA personal protective equipment requirements. Additionally all personnel shall wear hard hats, safety glasses and steel toed shoes when ever they are in the work area. The Contractor shall provide and install signage at all entrances to work areas identifying the minimum required PPE.

2.25 ACCIDENT REPORTING

As a minimum, the Contractor shall report all OSHA recordable or more severe accidents in writing to the Contracting Officer within 72 hours of the incident. The Contractor shall prepare and furnish a copy of its accident investigation report to the Contracting Officer.

PART 3 - SUBMITTALS & DEVIATIONS

3.1 REVIEW

- A. Contractor shall allow for a minimum of 21 days for submittal review from the time the submittals are received by the A/E until they are returned by the COTR to the Contractor. Submittals on finishes related to textures, patterns, and colors of materials shall be submitted as one complete package so that all finish materials may be coordinated and selected at one time.
- B. VA approval of samples, certificates, manufacturers' literature and data, and shop drawings will be subject to contract requirements and shall not relieve the Contractor from responsibility for errors or any sort in such submittals or from any unauthorized deviations from contract requirements.

3.2 DEVIATION REQUESTS

- A. Any request for deviation from the contract documents shall be submitted separately from other submittals and shall state clearly it is a substitution request so as not to be confused with a submittal review.
- B. The Contractor shall be responsible for the proposed deviation coordination with all utilities and other specification sections. The requested substitution shall not relieve the Contractor of any other contract conditions unless explicitly identified in the deviation request.
- C. Any deviation request will not be accepted until the Contracting Officer issues a Contract Change Order.
- D. Nothing in the contract shall require the Government to accept a deviation from the contract documents.

3.3 ADDITIONAL INFORMATION

The above information shall be used in conjunction with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA AND SAMPLES.

- - - END - - -

SECTION 01 33 23
SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES

- 1-1. Refer to Articles titled SPECIFICATIONS AND DRAWINGS FOR CONSTRUCTION (FAR 52.236-21) and, SPECIAL NOTES (VAAR 852.236-91), in GENERAL CONDITIONS.
- 1-2. For the purposes of this contract, samples, test reports, certificates, and manufacturers' literature and data shall also be subject to the previously referenced requirements. The following text refers to all items collectively as SUBMITTALS.
- 1-3. Submit for approval, all of the items specifically mentioned under the separate sections of the specification, with information sufficient to evidence full compliance with contract requirements. Materials, fabricated articles and the like to be installed in permanent work shall equal those of approved submittals. After an item has been approved, no change in brand or make will be permitted unless:
 - A. Contractor shall submit a project schedule prior to commencing with work, an updated progress schedule shall be submitted prior to each request for payment.
 - B. Satisfactory written evidence is presented to, and approved by Contracting Officer, that manufacturer cannot make scheduled delivery of approved item or;
 - C. Item delivered has been rejected and substitution of a suitable item is an urgent necessity or;
 - D. Other conditions become apparent which indicates approval of such substitute item to be in best interest of the Government.
- 1-4. Forward submittals in sufficient time to permit proper consideration and approval action by Government. Time submission to assure adequate lead time for procurement of contract - required items. Delays attributable to untimely and rejected submittals will not serve as a basis for extending contract time for completion. Allow a minimum of 21 days for submittal review from the time the submittals are received by the Architect until they are returned by the COTR to the Contractor. Submittals on finishes related to textures, patterns, and colors of materials shall be submitted as one complete package so that all finish materials may be coordinated and selected at one time.
- 1-5. Submittals will be reviewed for compliance with contract documents by Architect-Engineer, and action thereon will be taken by Resident Engineer on behalf of the Contracting Officer.

- 1-6. Upon receipt of submittals, Architect-Engineer will assign a file number thereto. Contractor, in any subsequent correspondence, shall refer to this file and identification number to expedite replies relative to previously approved or disapproved submittals.
- 1-7. The Government reserves the right to require additional submittals, whether or not particularly mentioned in this contract. If additional submittals beyond those required by the contract are furnished pursuant to request therefor by Contracting Officer, adjustment in contract price and time will be made in accordance with Articles titled CHANGES (FAR 52.243-4) and CHANGES - SUPPLEMENT (VAAR 852.236-88) of the GENERAL CONDITIONS.
- 1-8. Schedules called for in specifications and shown on shop drawings shall be submitted for use and information of Department of Veterans Affairs and Architect-Engineer. However, the Contractor shall assume responsibility for coordinating and verifying schedules. The Contracting Officer and Architect-Engineer assumes no responsibility for checking schedules or layout drawings for exact sizes, exact numbers and detailed positioning of items.
- 1-9. Submittals must be submitted by Contractor only and shipped prepaid where applicable. Contracting Officer assumes no responsibility for checking quantities or exact numbers included in such submittals.
 - A. Submit hard copies of samples in single units unless otherwise specified. Submit shop drawings, calculations, schedules, manufacturers' literature and data, certificates, etc in electronic PDF format to Architect-Engineer. Hard copies of submittals, except requested samples, will be rejected. Acceptable methods of electronic submittal transfer include email (preferred), thumb drive, CD/DVD, contractor hosted FTP site, or a combination of these. Electronic files shall be in PDF format, and maximum email attachment size is 5 MB. Upon review, the Architect-Engineer shall retain an electronic copy, and email/deliver an electronic copy with disposition stamps, signatures, and notations, electronically marked thereon to the COTR. The COTR will return the final approved/disapproved electronic submittal back to the contractor.
 - B. Submittals will receive consideration only when accompanied by a transmittal letter signed by the Contractor. Letter shall contain the list of items, name of Medical Center, name of Contractor, contract number, applicable specification paragraph numbers, applicable drawing numbers (and other information required for exact identification of

location for each item), manufacturer and brand, ASTM or Federal Specification Number (if any) and such additional information as may be required by specifications for particular item being furnished. In addition, catalog pages shall be noted to indicate specific items submitted for approval.

1. A copy of letter must be enclosed with items, and any items received without identification letter will be considered "unclaimed goods" and held for a limited time only.
 2. Each sample shall be labeled to indicate the name and location of the Medical Center, name of Contractor, manufacturer, brand, contract number and ASTM or Federal Specification Number as applicable and location(s) on project.
 3. Certificates and manufacturers' literature and data shall be labeled to indicate the name and location of the Medical Center, name of Contractor, manufacturer, brand, contract number and ASTM or Federal Specification Number as applicable and location(s) on project.
 4. Required certificates shall be signed by an authorized representative of manufacturer or supplier of material, and by Contractor, and electronically enclosed with submittal.
 5. At project close-out, the contractor will provide the COTR with hard copies of certificates and warranties within the O & M Manuals.
- C. If submittal samples have been disapproved, resubmit new samples as soon as possible after notification of disapproval. Such new samples shall be marked "Resubmitted Sample" in addition to containing other previously specified information required on label and in transmittal letter.
- D. Approved samples will be kept on file by the COTR at the site until completion of contract, at which time such samples will be delivered to Contractor as Contractor's property. Where noted in technical sections of specifications, approved samples in good condition may be used in their proper locations in contract work. At completion of contract, samples that are not approved will be returned to Contractor only upon request and at Contractor's expense. Such request should be made prior to completion of the contract. Disapproved samples that are not requested for return by Contractor will be discarded after completion of contract.
- E. Submittal drawings (shop, erection or setting drawings) and schedules, required for work of various trades, shall be checked before submission by technically qualified employees of Contractor for accuracy, completeness and compliance with contract requirements. These drawings

and schedules shall be stamped and signed by Contractor certifying to such check.

1. For each drawing required, submit one electronic PDF file.
 2. PDF shall be full size (760 mm by 1065 mm (30 inches x 42 inches)).
 3. Each drawing shall have marked thereon, proper descriptive title, including Medical Center location, project number, manufacturer's number, reference to contract drawing number, detail Section Number, and Specification Section Number.
 4. A space 120 mm by 125 mm (4-3/4 by 5 inches) shall be reserved on each drawing to accommodate an approval or disapproval stamp.
 5. Submit drawings Electronically as noted above.
 7. When work is directly related and involves more than one trade, shop drawings shall be submitted to Architect-Engineer under one cover.
- F. Any deviation from the contract requirements and justification therefore shall be so stated in the letter of transmittal.
- G. No fabrication of work shall be done or any part or parts thereof shipped to the site prior to approval of require shop drawings for such work.
- H. VA approval of samples, certificates, manufacturers' literature and data, and shop drawing will be subject to contract requirements and shall note relieve the contractor from responsibility for errors of any sort in such submittals or from any authorized deviations from contract requirements. An authorized deviation is a deviation that has been identified by the contractor, or Government, and confirmed by an appropriate contract modification.
- 1-10. Samples, shop drawings, test reports, certificates and manufacturers' literature and data, shall be submitted for approval to

CSHQA, a design collaboration

(Architect-Engineer)

250 South 5th Street

(A/E P.O. Address)

tim.higley@cshqa.com

(Email Address)

Boise, Idaho 83702

(City, State and Zip Code)

1-11. At the time of transmittal to the Architect-Engineer, the Contractor shall also send/email an electronic copy of the complete submittal directly to the COTR.

- - - E N D - - -

SECTION 01 42 19
REFERENCE STANDARDS

PART 1 - GENERAL

1.1 DESCRIPTION

This section specifies the availability and source of references and standards specified in the project manual under paragraphs APPLICABLE PUBLICATIONS and/or shown on the drawings.

1.2 AVAILABILITY OF SPECIFICATIONS LISTED IN THE GSA INDEX OF FEDERAL SPECIFICATIONS, STANDARDS AND COMMERCIAL ITEM DESCRIPTIONS FPMR PART 101-29 (FAR 52.211-1) (AUG 1998)

- A. The GSA Index of Federal Specifications, Standards and Commercial Item Descriptions, FPMR Part 101-29 and copies of specifications, standards, and commercial item descriptions cited in the solicitation may be obtained for a fee by submitting a request to - GSA Federal Supply Service, Specifications Section, Suite 8100, 470 East L'Enfant Plaza, SW, Washington, DC 20407, Telephone (202) 619-8925, Facsimile (202) 6198978.
- B. If the General Services Administration, Department of Agriculture, or Department of Veterans Affairs issued this solicitation, a single copy of specifications, standards, and commercial item descriptions cited in this solicitation may be obtained free of charge by submitting a request to the addressee in paragraph (a) of this provision. Additional copies will be issued for a fee.

1.3 AVAILABILITY FOR EXAMINATION OF SPECIFICATIONS NOT LISTED IN THE GSA INDEX OF FEDERAL SPECIFICATIONS, STANDARDS AND COMMERCIAL ITEM DESCRIPTIONS (FAR 52.211-4) (JUN 1988)

The specifications and standards cited in this solicitation can be examined at the following location:

DEPARTMENT OF VETERANS AFFAIRS

Office of Construction & Facilities Management

Facilities Quality Service (00CFM1A)

811 Vermont Avenue, NW - Room 462

Washington, DC 20420

Telephone Numbers: (202) 461-8217 or (202) 461-8292

Between 9:00 AM - 3:00 PM

1.4 AVAILABILITY OF SPECIFICATIONS NOT LISTED IN THE GSA INDEX OF FEDERAL SPECIFICATIONS, STANDARDS AND COMMERCIAL ITEM DESCRIPTIONS (FAR 52.211-3) (JUN 1988)

The specifications cited in this solicitation may be obtained from the associations or organizations listed below.

AA	Aluminum Association Inc. http://www.aluminum.org
AABC	Associated Air Balance Council http://www.aabchg.com
AAMA	American Architectural Manufacturer's Association http://www.aamanet.org
AAN	American Nursery and Landscape Association http://www.anla.org
AASHTO	American Association of State Highway and Transportation Officials http://www.aashto.org
AATCC	American Association of Textile Chemists and Colorists http://www.aatcc.org
ACGIH	American Conference of Governmental Industrial Hygienists http://www.acgih.org
ACI	American Concrete Institute http://www.aci-int.net
ACPA	American Concrete Pipe Association http://www.concrete-pipe.org
ACPPA	American Concrete Pressure Pipe Association http://www.acppa.org
ADC	Air Diffusion Council http://flexibleduct.org
AGA	American Gas Association http://www.aga.org
AGC	Associated General Contractors of America http://www.agc.org
AGMA	American Gear Manufacturers Association, Inc. http://www.agma.org
AHAM	Association of Home Appliance Manufacturers http://www.aham.org
AISC	American Institute of Steel Construction http://www.aisc.org
AISI	American Iron and Steel Institute http://www.steel.org

AITC American Institute of Timber Construction
<http://www.aitc-glulam.org>

AMCA Air Movement and Control Association, Inc.
<http://www.amca.org>

ANLA American Nursery & Landscape Association
<http://www.anla.org>

ANSI American National Standards Institute, Inc.
<http://www.ansi.org>

APA The Engineered Wood Association
<http://www.apawood.org>

ARI Air-Conditioning and Refrigeration Institute
<http://www.ari.org>

ASAE American Society of Agricultural Engineers
<http://www.asae.org>

ASCE American Society of Civil Engineers
<http://www.asce.org>

ASHRAE American Society of Heating, Refrigerating, and
Air-Conditioning Engineers
<http://www.ashrae.org>

ASME American Society of Mechanical Engineers
<http://www.asme.org>

ASSE American Society of Sanitary Engineering
<http://www.asse-plumbing.org>

ASTM American Society for Testing and Materials
<http://www.astm.org>

AWI Architectural Woodwork Institute
<http://www.awinet.org>

AWS American Welding Society
<http://www.aws.org>

AWWA American Water Works Association
<http://www.awwa.org>

BHMA Builders Hardware Manufacturers Association
<http://www.buildershardware.com>

BIA Brick Institute of America
<http://www.bia.org>

CAGI Compressed Air and Gas Institute
<http://www.cagi.org>

CGA Compressed Gas Association, Inc.
<http://www.cganet.com>

CI The Chlorine Institute, Inc.
<http://www.chlorineinstitute.org>

CISCA Ceilings and Interior Systems Construction Association
<http://www.cisca.org>

CISPI Cast Iron Soil Pipe Institute
<http://www.cispi.org>

CLFMI Chain Link Fence Manufacturers Institute
<http://www.chainlinkinfo.org>

CPMB Concrete Plant Manufacturers Bureau
<http://www.cpmb.org>

CRA California Redwood Association
<http://www.calredwood.org>

CRSI Concrete Reinforcing Steel Institute
<http://www.crsi.org>

CTI Cooling Technology Institute
<http://www.cti.org>

DHI Door and Hardware Institute
<http://www.dhi.org>

EGSA Electrical Generating Systems Association
<http://www.egsa.org>

EEI Edison Electric Institute
<http://www.eei.org>

EPA Environmental Protection Agency
<http://www.epa.gov>

ETL ETL Testing Laboratories, Inc.
<http://www.etl.com>

FAA Federal Aviation Administration
<http://www.faa.gov>

FCC Federal Communications Commission
<http://www.fcc.gov>

FPS The Forest Products Society
<http://www.forestprod.org>

GANA Glass Association of North America
<http://www.cssinfo.com/info/gana.html/>

FM Factory Mutual Insurance
<http://www.fmglobal.com>

GA Gypsum Association
<http://www.gypsum.org>

GSA General Services Administration
<http://www.gsa.gov>

HI Hydraulic Institute
<http://www.pumps.org>

HPVA Hardwood Plywood & Veneer Association
<http://www.hpva.org>

ICBO International Conference of Building Officials
<http://www.icbo.org>

ICEA Insulated Cable Engineers Association Inc.
<http://www.icea.net>

ICAC Institute of Clean Air Companies
<http://www.icac.com>

IEEE Institute of Electrical and Electronics Engineers
<http://www.ieee.org/>

IMSA International Municipal Signal Association
<http://www.imsasafety.org>

IPCEA Insulated Power Cable Engineers Association

NBMA Metal Buildings Manufacturers Association
<http://www.mbma.com>

MSS Manufacturers Standardization Society of the Valve and Fittings Industry Inc.
<http://www.mss-hq.com>

NAAMM National Association of Architectural Metal Manufacturers
<http://www.naamm.org>

NAPHCC Plumbing-Heating-Cooling Contractors Association
<http://www.phccweb.org.org>

NBS National Bureau of Standards
See - NIST

NBBPVI National Board of Boiler and Pressure Vessel Inspectors
<http://www.nationboard.org>

NEC National Electric Code
See - NFPA National Fire Protection Association

NEMA National Electrical Manufacturers Association
<http://www.nema.org>

NFPA National Fire Protection Association
<http://www.nfpa.org>

NHLA National Hardwood Lumber Association
<http://www.natlhardwood.org>

NIH National Institute of Health
<http://www.nih.gov>

NIST National Institute of Standards and Technology
<http://www.nist.gov>

NLMA Northeastern Lumber Manufacturers Association, Inc.
<http://www.nelma.org>

NPA National Particleboard Association
18928 Premiere Court
Gaithersburg, MD 20879
(301) 670-0604

NSF National Sanitation Foundation
<http://www.nsf.org>

NWWDA Window and Door Manufacturers Association
<http://www.nwwda.org>

OSHA Occupational Safety and Health
Administration
Department of Labor <http://www.osha.gov>

PCA Portland Cement Association
<http://www.portcement.org>

PCI Precast Prestressed Concrete Institute
<http://www.pci.org>

PPI The Plastic Pipe Institute
<http://www.plasticpipe.org>

PEI Porcelain Enamel Institute, Inc.
<http://www.porcelainenamel.com>

PTI Post-Tensioning Institute
<http://www.post-tensioning.org>

RFCI The Resilient Floor Covering Institute
<http://www.rfci.com>

RIS Redwood Inspection Service
See - CRA

RMA Rubber Manufacturers Association, Inc.
<http://www.rma.org>

SCMA Southern Cypress Manufacturers Association
<http://www.cypressinfo.org>

SDI Steel Door Institute
<http://www.steeldoor.org>

IGMA Insulating Glass Manufacturers Alliance
<http://www.igmaonline.org>

SJI Steel Joist Institute
<http://www.steeljoist.org>

SMACNA Sheet Metal and Air-Conditioning Contractors
National Association, Inc.
<http://www.smacna.org>

SSPC The Society for Protective Coatings
<http://www.sspc.org>

STI Steel Tank Institute
<http://www.steeltank.com>

SWI Steel Window Institute
<http://www.steelwindows.com>

TCA Tile Council of America, Inc.
<http://www.tileusa.com>

TEMA Tubular Exchange Manufacturers Association
<http://www.tema.org>

TPI Truss Plate Institute, Inc.
583 D'Onofrio Drive; Suite
200 Madison, WI 53719
(608) 833-5900

UBC The Uniform Building Code
See ICBO

UL Underwriters' Laboratories Incorporated
<http://www.ul.com>

ULC Underwriters' Laboratories of Canada
<http://www.ulc.ca>

WCLIB West Coast Lumber Inspection Bureau
6980 SW Varns Road, P.O. Box 23145
Portland, OR 97223
(503) 639-0651

WRCLA Western Red Cedar Lumber Association
P.O. Box 120786
New Brighton, MN 55112
(612) 633-4334

WWPA Western Wood Products Association
<http://www.wwpa.org>

- - - E N D - - -

THIS PAGE INTENTIONALLY LEFT BLANK

SECTION 01 45 29
TESTING LABORATORY SERVICES

PART 1 - GENERAL

1.1 DESCRIPTION:

This section specifies materials testing activities and inspection services required during project construction to be provided by a Testing Laboratory retained and paid for by Contractor.

1.2 APPLICABLE PUBLICATIONS:

- A. The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only.
- B. American Association of State Highway and Transportation Officials (AASHTO):
- T27-06Sieve Analysis of Fine and Coarse Aggregates
- T96-02 (R2006)Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine
- T99-01 (R2004) The Moisture-Density Relations of Soils Using a 2.5 Kg (5.5 lb.) Rammer and a 305 mm (12 in.) Drop
- T104-99 (R2003) Soundness of Aggregate by Use of Sodium Sulfate or Magnesium Sulfate
- T180-01 (R2004) Moisture-Density Relations of Soils using a 4.54 kg (10 lb.) Rammer and a 457 mm (18 in.) Drop
- T191-02(R2006) Density of Soil In-Place by the Sand-Cone Method
- C. American Concrete Institute (ACI):
- 506.4R-94 (R2004)Guide for the Evaluation of Shotcrete
- D. American Society for Testing and Materials (ASTM):
- A325-06Structural Bolts, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength
- A370-07 Definitions for Mechanical Testing of Steel Products
- A416/A416M-06 Steel Strand, Uncoated Seven-Wire for Prestressed Concrete
- A490-06 Heat Treated Steel Structural Bolts, 150 ksi Minimum Tensile Strength
- C31/C31M-06 Making and Curing Concrete Test Specimens in the Field
- C33-03Concrete Aggregates

C39/C39M-05	.....	Compressive Strength of Cylindrical Concrete Specimens
C109/C109M-05	.....	Compressive Strength of Hydraulic Cement Mortars
C138-07	.....	Unit Weight, Yield, and Air Content (Gravimetric) of Concrete
C140-07	.....	Sampling and Testing Concrete Masonry Units and Related Units
C143/C143M-05	.....	Slump of Hydraulic Cement Concrete
C172-07	.....	Sampling Freshly Mixed Concrete
C173-07	.....	Air Content of freshly Mixed Concrete by the Volumetric Method
C330-05	.....	Lightweight Aggregates for Structural Concrete
C567-05	.....	Density Structural Lightweight Concrete
C780-07	.....	Pre-construction and Construction Evaluation of Mortars for Plain and Reinforced Unit Masonry
C1019-08	.....	Sampling and Testing Grout
C1064/C1064M-05	.....	Freshly Mixed Portland Cement Concrete
C1077-06	.....	Laboratories Testing Concrete and Concrete Aggregates for Use in Construction and Criteria for Laboratory Evaluation
C1314-07	.....	Compressive Strength of Masonry Prisms
D698-07	.....	Laboratory Compaction Characteristics of Soil Using Standard Effort
D1143-07	.....	Piles Under Static Axial Compressive Load
D1188-07	.....	Bulk Specific Gravity and Density of Compacted Bituminous Mixtures Using Paraffin-Coated Specimens
D1556-07	.....	Density and Unit Weight of Soil in Place by the Sand-Cone Method
D1557-07	.....	Laboratory Compaction Characteristics of Soil Using Modified Effort
D2166-06	.....	Unconfined Compressive Strength of Cohesive Soil
D2167-94(R2001)	.....	Density and Unit Weight of Soil in Place by the Rubber Balloon Method
D2216-05	.....	Laboratory Determination of Water (Moisture) Content of Soil and Rock by Mass
D2922-05	.....	Density of soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth)
D2974-07	.....	Moisture, Ash, and Organic Matter of Peat and Other Organic Soils

D3666-(2002)	.....	Minimum Requirements for Agencies Testing and Inspection Bituminous Paving Materials
D3740-07	.....	Minimum Requirements for Agencies Engaged in the Testing and Inspecting Road and Paving Material
E94-04	.....	Radiographic Testing
E164-03	.....	Ultrasonic Contact Examination of Weldments
E329-07	.....	Agencies Engaged in Construction Inspection and/or Testing
E543-06	.....	Agencies Performing Non-Destructive Testing
E605-93(R2006)	.....	Thickness and Density of Sprayed Fire-Resistive Material (SFRM) Applied to Structural Members
E709-(2001)	.....	Guide for Magnetic Particle Examination
E1155-96(R2008)	.....	Determining FF Floor Flatness and FL Floor Levelness Numbers

E. American Welding Society (AWS):

D1.1-07	Structural Welding Code-Steel
---------	-------	-------------------------------

1.3 REQUIREMENTS:

- A. Accreditation Requirements: Construction materials testing laboratories must be accredited by a laboratory accreditation authority and will be required to submit a copy of the Certificate of Accreditation and Scope of Accreditation. The laboratory's scope of accreditation must include the appropriate ASTM standards (i.e.; E 329, C 1077, D 3666, D3740, A 880, E 543) listed in the technical sections of the specifications. Laboratories engaged in Hazardous Materials Testing shall meet the requirements of OSHA and EPA. The policy applies to the specific laboratory performing the actual testing, not just the "Corporate Office."
- B. Inspection and Testing: Testing laboratory shall inspect materials and workmanship and perform tests described herein and additional tests requested by COTR. When it appears materials furnished, or work performed by Contractor, fail to meet construction contract requirements, Testing Laboratory shall direct attention of COTR to such failure.
- C. Written Reports: Testing laboratory shall submit test reports to COTR, Contractor, unless other arrangements are agreed to in writing by the COTR. Submit reports of tests that fail to meet construction contract requirements on colored paper.
- D. Verbal Reports: Give verbal notification to COTR immediately of any irregularity.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.1 EARTHWORK:

A. General: The Testing Laboratory shall provide qualified personnel, materials, equipment, and transportation as required to perform the services identified/required herein, within the agreed to schedule and/or time frame. The work to be performed shall be as identified herein and shall include but not be limited to the following:

1. Observe fill and subgrades during proof-rolling to evaluate suitability of surface material to receive fill or base course. Provide recommendations to the COTR regarding suitability or unsuitability of areas where proof-rolling was observed. Where unsuitable results are observed, witness excavation of unsuitable material and recommend to COTR extent of removal and replacement of unsuitable materials and observe proof-rolling of replaced areas until satisfactory results are obtained.
2. Provide part time observation of fill placement and compaction and field density testing in building areas and retaining walls for foundation and backfill and pavement areas to verify that earthwork compaction obtained is in accordance with contract documents.
3. Provide supervised geotechnical technician to inspect excavation, subsurface preparation, and backfill for structural fill.

B. Testing Compaction:

1. Determine maximum density and optimum moisture content for each type of fill, backfill and subgrade material used, in compliance with ASTM D698 and/or ASTM D1557.
2. Make field density tests in accordance with the primary testing method following ASTM D2922 wherever possible. Field density tests utilizing ASTM D1556 or ASTM D2167 shall be utilized on a case by case basis only if there are problems with the validity of the results from the primary method due to specific site field conditions. Should the testing laboratory propose these alternative methods, they should provide satisfactory explanation to the COTR before the tests are conducted.
 - a. Building Slab Subgrade: At least one test of subgrade for every 185 m² (2000 square feet) of building slab, but in no case fewer than three tests. In each compacted fill layer, perform one test for every 185 m² (2000 square feet) of overlaying building slab, but in no case fewer than three tests.

- b. Foundation Wall Backfill: One test per 30 m (100 feet) of each layer of compacted fill but in no case fewer than two tests.
 - c. Pavement Subgrade: One test for each 335 m² (400 square yards), but in no case fewer than two tests.
 - d. Curb, Gutter, and Sidewalk: One test for each 90 m (300 feet), but in no case fewer than two tests.
 - e. Trenches: One test at maximum 30 m (100 foot) intervals per 1200 mm (4 foot) of vertical lift and at changes in required density, but in no case fewer than two tests.
 - f. Footing Subgrade: At least one test for each layer of soil on which footings will be placed. Subsequent verification and approval of each footing subgrade may be based on a visual comparison of each subgrade with related tested subgrade when acceptable to COTR. In each compacted fill layer below wall footings, perform one field density test for every 30 m (100 feet) of wall. Verify subgrade is level, all loose or disturbed soils have been removed, and correlate actual soil conditions observed with those indicated by test borings.
- C. Testing for Footing Bearing Capacity: Evaluate if suitable bearing capacity material is encountered in footing subgrade.
- D. Testing Materials: Test suitability of on-site and off-site borrow as directed by COTR.

3.2 LANDSCAPING:

- A. Test topsoil for organic materials, pH, phosphate, potash content, and gradation of particles.
 - 1. Test for organic material by using ASTM D2974.
 - 2. Determine percent of silt, sand, clay, and foreign materials such as rock, roots, and vegetation.
- B. Submit laboratory test report of topsoil to COTR.

3.3 ASPHALT CONCRETE PAVING:

- A. Aggregate Base Course:
 - 1. Determine maximum density and optimum moisture content for aggregate base material in accordance with ASTM D1557, Method D.
 - 2. Make a minimum of three field density tests on each day's final compaction on each aggregate course in accordance with ASTM D1556.
 - 3. Sample and test aggregate as necessary to insure compliance with specification requirements for gradation, wear, and soundness as specified in the applicable state highway standards and specifications.

B. Asphalt Concrete:

1. Aggregate: Sample and test aggregates in stock pile and hot-bins as necessary to insure compliance with specification requirements for gradation (AASHTO T27), wear (AASHTO T96), and soundness (AASHTO T104).
2. Temperature: Check temperature of each load of asphalt concrete at mixing plant and at site of paving operation.
3. Density: Make a minimum of two field density tests in accordance with ASTM D1188 of asphalt base and surface course for each day's paving operation.

3.4 SITE WORK CONCRETE:

Test site work concrete including materials for concrete as required in Article CONCRETE of this section.

3.5 CONCRETE:**A. Batch Plant Inspection and Materials Testing:**

1. Perform continuous batch plant inspection until concrete quality is established to satisfaction of COTR with concurrence of Contracting Officer and perform periodic inspections thereafter as determined by COTR.
2. Periodically inspect and test batch proportioning equipment for accuracy and report deficiencies to COTR.
3. Sample and test mix ingredients as necessary to insure compliance with specifications.
4. Sample and test aggregates daily and as necessary for moisture content. Test the dry rodded weight of the coarse aggregate whenever a sieve analysis is made, and when it appears there has been a change in the aggregate.
5. Certify, in duplicate, ingredients and proportions and amounts of ingredients in concrete conform to approved trial mixes. When concrete is batched or mixed off immediate building site, certify (by signing, initialing or stamping thereon) on delivery slips (duplicate) that ingredients in truck-load mixes conform to proportions of aggregate weight, cement factor, and water-cement ratio of approved trial mixes.

B. Field Inspection and Materials Testing:

1. Provide a technician at site of placement at all times to perform concrete sampling and testing.
2. Review the delivery tickets of the ready-mix concrete trucks arriving on-site. Notify the Contractor if the concrete cannot be placed

- within the specified time limits or if the type of concrete delivered is incorrect. Reject any loads that do not comply with the Specification requirements. Rejected loads are to be removed from the site at the Contractor's expense. Any rejected concrete that is placed will be subject to removal.
3. Take concrete samples at point of placement in accordance with ASTM C172. Mold and cure compression test cylinders in accordance with ASTM C31. Make at least three cylinders for each 40 m³ (50 cubic yards) or less of each concrete type, and at least three cylinders for any one day's pour for each concrete type. After good concrete quality control has been established and maintained as determined by Resident Engineer make three cylinders for each 80 m³ (100 cubic yards) or less of each concrete type, and at least three cylinders from any one day's pour for each concrete type. // Label each cylinder with an identification number. COTR may require additional cylinders to be molded and cured under job conditions.
 4. Perform slump tests in accordance with ASTM C143. Test the first truck each day, and every time test cylinders are made. Test pumped concrete at the hopper and at the discharge end of the hose at the beginning of each day's pumping operations to determine change in slump.
 5. Determine the air content of concrete per ASTM C173. For concrete required to be air-entrained, test the first truck and every 20 m³ (25 cubic yards) thereafter each day. For concrete not required to be air-entrained, test every 80 m³ (100 cubic yards) at random. For pumped concrete, initially test concrete at both the hopper and the discharge end of the hose to determine change in air content.
 6. If slump or air content fall outside specified limits, make another test immediately from another portion of same batch.
 7. Perform unit weight tests in compliance with ASTM C138 for normal weight concrete and ASTM C567 for lightweight concrete. Test the first truck and each time cylinders are made.
 8. Notify laboratory technician at batch plant of mix irregularities and request materials and proportioning check.
 9. Verify that specified mixing has been accomplished.
 10. Environmental Conditions: Determine the temperature per ASTM C1064 for each truckload of concrete during hot weather and cold weather concreting operations:
 - a. When ambient air temperature falls below 4.4 degrees C (40 degrees F), record maximum and minimum air temperatures in each 24 hour

- period; record air temperature inside protective enclosure; record minimum temperature of surface of hardened concrete.
- b. When ambient air temperature rises above 29.4 degrees C (85 degrees F), record maximum and minimum air temperature in each 24 hour period; record minimum relative humidity; record maximum wind velocity; record maximum temperature of surface of hardened concrete.
11. Inspect the reinforcing steel placement, including bar size, bar spacing, top and bottom concrete cover, proper tie into the chairs, and grade of steel prior to concrete placement. Submit detailed report of observations.
12. Observe conveying, placement, and consolidation of concrete for conformance to specifications.
13. Observe condition of formed surfaces upon removal of formwork prior to repair of surface defects and observe repair of surface defects.
14. Observe curing procedures for conformance with specifications, record dates of concrete placement, start of preliminary curing, start of final curing, end of curing period.
15. Observe preparations for placement of concrete:
- a. Inspect handling, conveying, and placing equipment, inspect vibrating and compaction equipment.
 - b. Inspect preparation of construction, expansion, and isolation joints.
16. Observe preparations for protection from hot weather, cold weather, sun, and rain, and preparations for curing.
17. Observe concrete mixing:
- a. Monitor and record amount of water added at project site.
 - b. Observe minimum and maximum mixing times.
18. Measure concrete flatwork for levelness and flatness as follows:
- a. Perform Floor Tolerance Measurements F_F and F_L in accordance with ASTM E1155. Calculate the actual overall F- numbers using the inferior/superior area method.
 - b. Perform all floor tolerance measurements within 48 hours after slab installation and prior to removal of shoring and formwork.
 - c. Provide the Contractor and the COTR with the results of all profile tests, including a running tabulation of the overall F_F and F_L values for all slabs installed to date, within 72 hours after each slab installation.

19. Other inspections:

- a. Grouting under base plates.
- b. Grouting anchor bolts and reinforcing steel in hardened concrete.

C. Laboratory Tests of Field Samples:

1. Test compression test cylinders for strength in accordance with ASTM C39. For each test series, test one cylinder at 7 days and one cylinder at 28 days. Use remaining cylinder as a spare tested as directed by COTR. Compile laboratory test reports as follows: Compressive strength test shall be result of one cylinder, except when one cylinder shows evidence of improper sampling, molding or testing, in which case it shall be discarded and strength of spare cylinder shall be used.
2. Make weight tests of hardened lightweight structural concrete in accordance with ASTM C567.
3. Furnish certified compression test reports (duplicate) to COTR. In test report, indicate the following information:
 - a. Cylinder identification number and date cast.
 - b. Specific location at which test samples were taken.
 - c. Type of concrete, slump, and percent air.
 - d. Compressive strength of concrete in MPa (psi).
 - e. Weight of lightweight structural concrete in kg/m³ (pounds per cubic feet).
 - f. Weather conditions during placing.
 - g. Temperature of concrete in each test cylinder when test cylinder was molded.
 - h. Maximum and minimum ambient temperature during placing.
 - i. Ambient temperature when concrete sample in test cylinder was taken.
 - j. Date delivered to laboratory and date

tested. 3.8 ARCHITECTURAL PRECAST CONCRETE:

- A. Inspection at Plant: Forms, placement of reinforcing steel, concrete cover, and placement and finishing of concrete.
- B. Concrete Testing: Test concrete including materials for concrete as required in Article CONCRETE of this section, except make two test cylinders for each day's production of each strength of concrete produced.
- C. Inspect members to insure specification requirements for curing and finishes have been met.

3.9 MASONRY:

A. Mortar Tests:

1. Laboratory compressive strength test:
 - a. Comply with ASTM C780.
 - b. Obtain samples during or immediately after discharge from batch mixer.
 - c. Furnish molds with 50 mm (2 inch), 3 compartment gang cube.
 - d. Test one sample at 7 days and 2 samples at 28 days.
2. Two tests during first week of operation; one test per week after initial test until masonry completion.

B. Grout Tests:

1. Laboratory compressive strength test:
 - a. Comply with ASTM C1019.
 - b. Test one sample at 7 days and 2 samples at 28 days.
 - c. Perform test for each 230 m² (2500 square feet) of masonry.

C. Masonry Unit Tests:

1. Laboratory Compressive Strength Test:
 - a. Comply with ASTM C140.
 - b. Test 3 samples for each 460 m² (5000 square feet) of wall area.

- D. Prism Tests: For each type of wall construction indicated, test masonry prisms per ASTM C1314 for each 460 m² (5000 square feet) of wall area. Prepare one set of prisms for testing at 7 days and one set for testing at 28 days.

3.10 STRUCTURAL STEEL:

A. General: Provide shop and field inspection and testing services to certify structural steel work is done in accordance with contract documents. Welding shall conform to AWS D1.1 Structural Welding Code.

B. Prefabrication Inspection:

1. Review design and shop detail drawings for size, length, type and location of all welds to be made.
2. Approve welding procedure qualifications either by pre-qualification or by witnessing qualifications tests.
3. Approve welder qualifications by certification or retesting.
4. Approve procedure for control of distortion and shrinkage stresses.
5. Approve procedures for welding in accordance with applicable sections of AWS D1.1.

C. Fabrication and Erection:

1. Weld Inspection:

- a. Inspect welding equipment for capacity, maintenance and working condition.
 - b. Verify specified electrodes and handling and storage of electrodes in accordance with AWS D1.1.
 - c. Inspect preparation and assembly of materials to be welded for conformance with AWS D1.1.
 - d. Inspect preheating and interpass temperatures for conformance with AWS D1.1.
 - e. Measure 25 percent of fillet welds.
 - f. Welding Magnetic Particle Testing: Test in accordance with ASTM E709 for a minimum of:
 - 1) 20 percent of all shear plate fillet welds at random, final pass only.
 - 2) 20 percent of all continuity plate and bracing gusset plate fillet welds, at random, final pass only.
 - 3) 100 percent of tension member fillet welds (i.e., hanger connection plates and other similar connections) for root and final passes.
 - 4) 20 percent of length of built-up column member partial penetration and fillet welds at random for root and final passes.
 - 5) 100 percent of length of built-up girder member partial penetration and fillet welds for root and final passes.
 - g. Welding Ultrasonic Testing: Test in accordance with ASTM E164 and AWS D1.1 for 100 percent of all full penetration welds, braced and moment frame column splices, and a minimum of 20 percent of all other partial penetration column splices, at random.
 - h. Verify correction of rejected welds are made in accordance with AWS D1.1.
 - i. Testing and inspection do not relieve the Contractor of the responsibility for providing materials and fabrication procedures in compliance with the specified requirements.
2. Bolt Inspection:
- a. Inspect high-strength bolted connections in accordance AISC Specifications for Structural Joints Using ASTM A325 or A490 Bolts.
 - b. Slip-Critical Connections: Inspect 10 percent of bolts, but not less than 2 bolts, selected at random in each connection in accordance with AISC Specifications for Structural Joints Using

ASTM A325 or A490 Bolts. Inspect all bolts in connection when one or more are rejected.

- c. Fully Pre-tensioned Connections: Inspect 10 percent of bolts, but not less than 2 bolts, selected at random in 25 percent of connections in accordance with AISC Specification for Structural Joints Using ASTM A325 or A490 Bolts. Inspect all bolts in connection when one or more are rejected.
 - d. Bolts installed by turn-of-nut tightening may be inspected with calibrated wrench when visual inspection was not performed during tightening.
 - e. Snug Tight Connections: Inspect 10 percent of connections verifying that plies of connected elements have been brought into snug contact.
 - f. Inspect field erected assemblies; verify locations of structural steel for plumbness, level, and alignment.
- D. Submit inspection reports, record of welders and their certification, and identification, and instances of noncompliance to COTR.

3.11 STEEL DECKING:

- A. Provide field inspection of welds of metal deck to the supporting steel, and testing services to insure steel decking has been installed in accordance with contract documents and manufacturer's requirements.
- B. Qualification of Field Welding: Qualify welding processes and welding operators in accordance with "Welder Qualification" procedures of AWS D1.1. Refer to the "Plug Weld Qualification Procedure" in Part 3 "Field Quality Control."
- C. Submit inspection reports, certification, and instances of noncompliance to COTR.

3.12 SHEAR CONNECTOR STUDS:

- A. Provide field inspection and testing services required by AWS D.1 to insure shear connector studs have been installed in accordance with contract documents.
- B. Tests: Test 20 percent of headed studs for fastening strength in accordance with AWS D1.1.
- C. Submit inspection reports, certification, and instances of noncompliance to COTR.

3.13 SPRAYED-ON FIREPROOFING:

- A. Provide field inspection and testing services to certify sprayed-on fireproofing has been applied in accordance with contract documents.
- B. Obtain a copy of approved submittals from COTR.

- C. Use approved installation in test areas as criteria for inspection of work.
- D. Test sprayed-on fireproofing for thickness and density in accordance with ASTM E605.
 - 1. Thickness gauge specified in ASTM E605 may be modified for pole extension so that overhead sprayed material can be reached from floor.
- E. Location of test areas for field tests as follows:
 - 1. Thickness: Select one bay per floor, or one bay for each 930 m² (10,000 square feet) of floor area, whichever provides for greater number of tests. Take thickness determinations from each of following locations: Metal deck, beam, and column.
 - 2. Density: Take density determinations from each floor, or one test from each 930 m² (10,000 square feet) of floor area, whichever provides for greater number of tests, from each of the following areas: Underside of metal deck, beam flanges, and beam web.
- F. Submit inspection reports, certification, and instances of noncompliance to COTR.

- - - E N D - - -

THIS PAGE INTENTIONALLY LEFT BLANK

SECTION 01 57 19
TEMPORARY ENVIRONMENTAL CONTROLS

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This section specifies the control of environmental pollution and damage that the Contractor must consider for air, water, and land resources. It includes management of visual aesthetics, noise, solid waste, radiant energy, and radioactive materials, as well as other pollutants and resources encountered or generated by the Contractor. The Contractor is obligated to consider specified control measures with the costs included within the various contract items of work.
- B. Environmental pollution and damage is defined as the presence of chemical, physical, or biological elements or agents which:
1. Adversely effect human health or welfare,
 2. Unfavorably alter ecological balances of importance to human life,
 3. Effect other species of importance to humankind, or;
 4. Degrade the utility of the environment for aesthetic, cultural, and historical purposes.
- C. Definitions of Pollutants:
1. Chemical Waste: Petroleum products, bituminous materials, salts, acids, alkalis, herbicides, pesticides, organic chemicals, and inorganic wastes.
 2. Debris: Combustible and noncombustible wastes, such as leaves, tree trimmings, ashes, and waste materials resulting from construction or maintenance and repair work.
 3. Sediment: Soil and other debris that has been eroded and transported by runoff water.
 4. Solid Waste: Rubbish, debris, garbage, and other discarded solid materials resulting from industrial, commercial, and agricultural operations and from community activities.
 5. Surface Discharge: The term "Surface Discharge" implies that the water is discharged with possible sheeting action and subsequent soil erosion may occur. Waters that are surface discharged may terminate in drainage ditches, storm sewers, creeks, and/or "water of the United States" and would require a permit to discharge water from the governing agency.
 6. Rubbish: Combustible and noncombustible wastes such as paper, boxes, glass and crockery, metal and lumber scrap, tin cans, and bones.

7. Sanitary Wastes:

- a. Sewage: Domestic sanitary sewage and human and animal waste.
- b. Garbage: Refuse and scraps resulting from preparation, cooking, dispensing, and consumption of food.

1.2 QUALITY CONTROL

- A. Establish and maintain quality control for the environmental protection of all items set forth herein.
- B. Record on daily reports any problems in complying with laws, regulations, and ordinances. Note any corrective action taken.

1.3 REFERENCES

- A. The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.
- B. U.S. National Archives and Records Administration (NARA):
33 CFR 328Definitions
- C. SDC1.0 Demolition and Erosion Control Plan in the design documents shall serve as a base for the preparation of the Environmental Protection Plan. The Contractor shall modify the plan based on his means and methods.

1.4 SUBMITTALS

- A. In accordance with Section, 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES, furnish the following:
 - 1. Environmental Protection Plan: After the contract is awarded and prior to the commencement of the work, the Contractor shall meet with the COTR to discuss the proposed Environmental Protection Plan and to develop mutual understanding relative to details of environmental protection. Not more than 20 days after the meeting, the Contractor shall prepare and submit to the COTR for approval, a written and/or graphic Environmental Protection Plan including, but not limited to, the following:
 - a. Name(s) of person(s) within the Contractor's organization who is (are) responsible for ensuring adherence to the Environmental Protection Plan.
 - b. Name(s) and qualifications of person(s) responsible for manifesting hazardous waste to be removed from the site.
 - c. Name(s) and qualifications of person(s) responsible for training the Contractor's environmental protection personnel.
 - d. Description of the Contractor's environmental protection personnel training program.

- e. A list of Federal, State, and local laws, regulations, and permits concerning environmental protection, pollution control, noise control and abatement that are applicable to the Contractor's proposed operations and the requirements imposed by those laws, regulations, and permits.
- f. Methods for protection of features to be preserved within authorized work areas including trees, shrubs, vines, grasses, ground cover, landscape features, air and water quality, fish and wildlife, soil, historical, and archeological and cultural resources.
- g. Procedures to provide the environmental protection that comply with the applicable laws and regulations. Describe the procedures to correct pollution of the environment due to accident, natural causes, or failure to follow the procedures as described in the Environmental Protection Plan.
- h. Permits, licenses, and the location of the solid waste disposal area.
- i. Drawings showing locations of any proposed temporary excavations or embankments for haul roads, stream crossings, material storage areas, structures, sanitary facilities, and stockpiles of excess or spoil materials. Include as part of an Erosion Control Plan approved by the District Office of the U.S. Soil Conservation Service and the Department of Veterans Affairs.
- j. Environmental Monitoring Plans for the job site including land, water, air, and noise.
- k. Work Area Plan showing the proposed activity in each portion of the area and identifying the areas of limited use or nonuse. Plan should include measures for marking the limits of use areas. This plan may be incorporated within the Erosion Control Plan. B. Approval of the Contractor's Environmental Protection Plan will not relieve the Contractor of responsibility for adequate and continued control of pollutants and other environmental protection measures.

1.5 PROTECTION OF ENVIRONMENTAL RESOURCES

- A. Protect environmental resources within the project boundaries and those affected outside the limits of permanent work during the entire period of this contract. Confine activities to areas defined by the specifications and drawings.
- B. Protection of Land Resources: Prior to construction, identify all land resources to be preserved within the work area. Do not remove, cut,

deface, injure, or destroy land resources including trees, shrubs, vines, grasses, top soil, and land forms without permission from the COTR. Do not fasten or attach ropes, cables, or guys to trees for anchorage unless specifically authorized, or where special emergency use is permitted.

1. Work Area Limits: Prior to any construction, mark the areas that require work to be performed under this contract. Mark or fence isolated areas within the general work area that are to be saved and protected. Protect monuments, works of art, and markers before construction operations begin. Convey to all personnel the purpose of marking and protecting all necessary objects.
2. Protection of Landscape: Protect trees, shrubs, vines, grasses, land forms, and other landscape features shown on the drawings to be preserved by marking, fencing, or using any other approved techniques.
 - a. Box and protect from damage existing trees and shrubs to remain on the construction site.
 - b. Immediately repair all damage to existing trees and shrubs by trimming, cleaning, and painting with antiseptic tree paint.
 - c. Do not store building materials or perform construction activities closer to existing trees or shrubs than the farthest extension of their limbs.
3. Reduction of Exposure of Unprotected Erodible Soils: Plan and conduct earthwork to minimize the duration of exposure of unprotected soils. Clear areas in reasonably sized increments only as needed to use. Form earthwork to final grade as shown. Immediately protect side slopes and back slopes upon completion of rough grading.
4. Temporary Protection of Disturbed Areas: Construct diversion ditches, benches, and berms to retard and divert runoff from the construction site to protected drainage areas approved under paragraph 208 of the Clean Water Act.
5. Erosion and Sedimentation Control Devices: The erosion and sediment controls selected and maintained by the Contractor shall be such that water quality standards are not violated as a result of the Contractor's activities. Construct or install all temporary and permanent erosion and sedimentation control features shown on the Environmental Protection Plan. Maintain temporary erosion and sediment control measures such as berms, dikes, drains, sedimentation basins, grassing, and mulching, until permanent drainage and erosion control facilities are completed and operative.

6. Manage borrow areas on and off Government property to minimize erosion and to prevent sediment from entering nearby water courses or lakes.
 7. Manage and control spoil areas on and off Government property to limit spoil to areas shown on the Environmental Protection Plan and prevent erosion of soil or sediment from entering nearby water courses or lakes.
 8. Protect adjacent areas from despoilment by temporary excavations and embankments.
 9. Handle and dispose of solid wastes in such a manner that will prevent contamination of the environment. Place solid wastes (excluding clearing debris) in containers that are emptied on a regular schedule. Transport all solid waste off Government property and dispose of waste in compliance with Federal, State, and local requirements.
 10. Store chemical waste away from the work areas in corrosion resistant containers and dispose of waste in accordance with Federal, State, and local regulations.
 11. Handle discarded materials other than those included in the solid waste category as directed by the COTR.
- C. Protection of Water Resources: Keep construction activities under surveillance, management, and control to avoid pollution of surface and ground waters and sewer systems. Implement management techniques to control water pollution by the listed construction activities that are included in this contract.
1. Washing and Curing Water: Do not allow wastewater directly derived from construction activities to enter water areas. Collect and place wastewater in retention ponds allowing the suspended material to settle, the pollutants to separate, or the water to evaporate.
 2. Control movement of materials and equipment at stream crossings during construction to prevent violation of water pollution control standards of the Federal, State, or local government.
 3. Monitor water areas affected by construction.
- D. Protection of Fish and Wildlife Resources: Keep construction activities under surveillance, management, and control to minimize interference with, disturbance of, or damage to fish and wildlife. Prior to beginning construction operations, list species that require specific attention along with measures for their protection.

E. Protection of Air Resources: Keep construction activities under surveillance, management, and control to minimize pollution of air resources. Burning is not permitted on the job site. Keep activities, equipment, processes, and work operated or performed, in strict accordance with the State of Idaho Environmental Protection and Health Act (Title 39, Chapter 1) insert Name of State and title of State Air Pollution Statue, Rule, or Regulation // and Federal emission and performance laws and standards. Maintain ambient air quality standards set by the Environmental Protection Agency, for those construction operations and activities specified.

1. Particulates: Control dust particles, aerosols, and gaseous by-products from all construction activities, processing, and preparation of materials (such as from asphaltic batch plants) at all times, including weekends, holidays, and hours when work is not in progress.
2. Particulates Control: Maintain all excavations, stockpiles, haul roads, permanent and temporary access roads, plant sites, spoil areas, borrow areas, and all other work areas within or outside the project boundaries free from particulates which would cause a hazard or a nuisance. Sprinklering, chemical treatment of an approved type, light bituminous treatment, baghouse, scrubbers, electrostatic precipitators, or other methods are permitted to control particulates in the work area.
3. Hydrocarbons and Carbon Monoxide: Control monoxide emissions from equipment to Federal and State allowable limits.
4. Odors: Control odors of construction activities and prevent obnoxious odors from occurring.

F. Reduction of Noise: Minimize noise using every action possible. Perform noise-producing work in less sensitive hours of the day or week as directed by the Resident Engineer. Maintain noise-produced work at or below the decibel levels and within the time periods specified.

1. Perform construction activities involving repetitive, high-level impact noise only between 8:00 a.m. and 5:00 p.m. unless otherwise permitted by local ordinance or the COTR. Repetitive impact noise on the property shall not exceed the following dB limitations:

Time Duration of Impact Noise	Sound Level in dB
More than 12 minutes in any hour	70
Less than 30 seconds of any hour	85
Less than three minutes of any hour	80
Less than 12 minutes of any hour	75

2. Provide sound-deadening devices on equipment and take noise abatement measures that are necessary to comply with the requirements of this contract, consisting of, but not limited to, the following:

a. Maintain maximum permissible construction equipment noise levels at 15 m (50 feet) (dBA):

EARTHMOVING		MATERIALS HANDLING	
FRONT LOADERS	75	CONCRETE MIXERS	75
BACKHOES	75	CONCRETE PUMPS	75
DOZERS	75	CRANES	75
TRACTORS	75	DERRICKS IMPACT	75
SCAPERS	80	PILE DRIVERS	95
GRADERS	75	JACK HAMMERS	75
TRUCKS	75	ROCK DRILLS	80
PAVERS, STATIONARY	80	PNEUMATIC TOOLS	80
PUMPS	75	BLASTING	95
GENERATORS	75	SAWS	75
COMPRESSORS	75	VIBRATORS	75

- b. Use shields or other physical barriers to restrict noise transmission.
- c. Provide soundproof housings or enclosures for noise-producing machinery.
- d. Use efficient silencers on equipment air intakes.
- e. Use efficient intake and exhaust mufflers on internal combustion engines that are maintained so equipment performs below noise levels specified.
- f. Line hoppers and storage bins with sound deadening material.
- g. Conduct truck loading, unloading, and hauling operations so that noise is kept to a minimum.
3. Measure sound level for noise exposure due to the construction at least once every five successive working days while work is being performed above 55 dB(A) noise level. Measure noise exposure at the property line or 15 m (50 feet) from the noise source, whichever is greater. Measure the sound levels on the A weighing network of a General Purpose sound level meter at slow response. To minimize the effect of reflective sound waves at buildings, take measurements at 900 to 1800 mm (three to six feet) in front of any building face.

Submit the recorded information to the COTR noting any problems and the alternatives for mitigating actions.

- G. Restoration of Damaged Property: If any direct or indirect damage is done to public or private property resulting from any act, omission, neglect, or misconduct, the Contractor shall restore the damaged property to a condition equal to that existing before the damage at no additional cost to the Government. Repair, rebuild, or restore property as directed or make good such damage in an acceptable manner.
- H. Final Clean-up: On completion of project and after removal of all debris, rubbish, and temporary construction, Contractor shall leave the construction area in a clean condition satisfactory to the COTR. Cleaning shall include off the station disposal of all items and materials not required to be salvaged, as well as all debris and rubbish resulting from demolition and new work operations.

- - - E N D - - -

SECTION 01 74 19
CONSTRUCTION WASTE MANAGEMENT

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This section specifies the requirements for the management of nonhazardous building construction and demolition waste.
- B. Waste disposal in landfills shall be minimized to the greatest extent possible. Of the inevitable waste that is generated, as much of the waste material as economically feasible shall be salvaged, recycled or reused.
- C. Contractor shall use all reasonable means to divert construction and demolition waste from landfills and incinerators, and facilitate their salvage and recycle not limited to the following:
 - 1. Waste Management Plan development and implementation.
 - 2. Techniques to minimize waste generation.
 - 3. Sorting and separating of waste materials.
 - 4. Salvage of existing materials and items for reuse or resale.
 - 5. Recycling of materials that cannot be reused or sold.
- D. At a minimum the following waste categories shall be diverted from landfills:
 - 1. Soil.
 - 2. Inert materials (eg, concrete, masonry and asphalt).
 - 3. Clean dimensional wood and palette wood.
 - 4. Green waste (biodegradable landscaping materials).
 - 5. Engineered wood products (plywood, particle board and I-joists, etc).
 - 6. Metal products (eg, steel, wire, beverage containers, copper, etc).
 - 7. Cardboard, paper and packaging.
 - 8. Bitumen roofing materials.
 - 9. Plastics (eg, ABS, PVC).
 - 10. Carpet and/or pad.
 - 11. Gypsum board.
 - 12. Insulation.
 - 13. Paint.
 - 14. Fluorescent lamps.

1.2 RELATED WORK

- A. Section 02 41 00, DEMOLITION.
- B. Section 01 00 00, GENERAL REQUIREMENTS.

1.3 QUALITY ASSURANCE

- A. Contractor shall practice efficient waste management when sizing, cutting and installing building products. Processes shall be employed to ensure the generation of as little waste as possible. Construction /Demolition waste includes products of the following:
 - 1. Excess or unusable construction materials.
 - 2. Packaging used for construction products.
 - 3. Poor planning and/or layout.
 - 4. Construction error.
 - 5. Over ordering.
 - 6. Weather damage.
 - 7. Contamination.
 - 8. Mishandling.
 - 9. Breakage.
- B. Establish and maintain the management of non-hazardous building construction and demolition waste set forth herein. Conduct a site assessment to estimate the types of materials that will be generated by demolition and construction.
- C. Contractor shall develop and implement procedures to reuse and recycle new materials to a minimum of 50 percent.
- D. Contractor shall be responsible for implementation of any special programs involving rebates or similar incentives related to recycling. Any revenues or savings obtained from salvage or recycling shall accrue to the contractor.
- E. Contractor shall provide all demolition, removal and legal disposal of materials. Contractor shall ensure that facilities used for recycling, reuse and disposal shall be permitted for the intended use to the extent required by local, state, federal regulations. The Whole Building Design Guide website <http://www.wbdg.org> provides a Construction Waste Management Database that contains information on companies that haul, collect, and process recyclable debris from construction projects.

- F. Contractor shall assign a specific area to facilitate separation of materials for reuse, salvage, recycling, and return. Such areas are to be kept neat and clean and clearly marked in order to avoid contamination or mixing of materials.
- G. Contractor shall provide on-site instructions and supervision of separation, handling, salvaging, recycling, reuse and return methods to be used by all parties during waste generating stages.
- H. Record on daily reports any problems in complying with laws, regulations and ordinances with corrective action taken.

1.4 TERMINOLOGY

- A. Class III Landfill: A landfill that accepts non-hazardous resources such as household, commercial and industrial waste resulting from construction, remodeling, repair and demolition operations.
- B. Clean: Untreated and unpainted; uncontaminated with adhesives, oils, solvents, mastics and like products.
- C. Construction and Demolition Waste: Includes all non-hazardous resources resulting from construction, remodeling, alterations, repair and demolition operations.
- D. Dismantle: The process of parting out a building in such a way as to preserve the usefulness of its materials and components.
- E. Disposal: Acceptance of solid wastes at a legally operating facility for the purpose of land filling (includes Class III landfills and inert fills).
- F. Inert Backfill Site: A location, other than inert fill or other disposal facility, to which inert materials are taken for the purpose of filling an excavation, shoring or other soil engineering operation.
- G. Inert Fill: A facility that can legally accept inert waste, such as asphalt and concrete exclusively for the purpose of disposal.
- H. Inert Solids/Inert Waste: Non-liquid solid resources including, but not limited to, soil and concrete that does not contain hazardous waste or soluble pollutants at concentrations in excess of water-quality objectives established by a regional water board, and does not contain significant quantities of decomposable solid resources.
- I. Mixed Debris: Loads that include commingled recyclable and non-recyclable materials generated at the construction site.

- J. Mixed Debris Recycling Facility: A solid resource processing facility that accepts loads of mixed construction and demolition debris for the purpose of recovering re-usable and recyclable materials and disposing non-recyclable materials.
- K. Permitted Waste Hauler: A company that holds a valid permit to collect and transport solid wastes from individuals or businesses for the purpose of recycling or disposal.
- L. Recycling: The process of sorting, cleansing, treating, and reconstituting materials for the purpose of using the altered form in the manufacture of a new product. Recycling does not include burning, incinerating or thermally destroying solid waste.
1. On-site Recycling - Materials that are sorted and processed on site for use in an altered state in the work, i.e. concrete crushed for use as a sub-base in paving.
 2. Off-site Recycling - Materials hauled to a location and used in an altered form in the manufacture of new products.
- M. Recycling Facility: An operation that can legally accept materials for the purpose of processing the materials into an altered form for the manufacture of new products. Depending on the types of materials accepted and operating procedures, a recycling facility may or may not be required to have a solid waste facilities permit or be regulated by the local enforcement agency.
- N. Reuse: Materials that are recovered for use in the same form, on-site or off-site.
- O. Return: To give back reusable items or unused products to vendors for credit.
- P. Salvage: To remove waste materials from the site for resale or re-use by a third party.
- Q. Source-Separated Materials: Materials that are sorted by type at the site for the purpose of reuse and recycling.
- R. Solid Waste: Materials that have been designated as non-recyclable and are discarded for the purposes of disposal.
- S. Transfer Station: A facility that can legally accept solid waste for the purpose of temporarily storing the materials for re-loading onto other trucks and transporting them to a landfill for disposal, or recovering some materials for re-use or recycling.

1.5 SUBMITTALS

- A. In accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, and SAMPLES, furnish the following:
- B. Monthly summary of construction and demolition debris diversion and disposal, quantifying all materials generated at the work site and disposed of or diverted from disposal through recycling.

1.6 RECORDS

Maintain records to document the quantity of waste generated; the quantity of waste diverted through sale, reuse, or recycling; and the quantity of waste disposed by landfill or incineration.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. List of each material and quantity to be salvaged, recycled and reused.
- B. List of each material and quantity proposed to be taken to a landfill.
- C. Material tracking data: Receiving parties, dates removed, transportation costs, weight tickets, tipping fees, manifests, invoices, net total costs, or savings.

PART 3 - EXECUTION

3.1 COLLECTION

- A. Provide all necessary containers, bins and storage areas to facilitate effective waste management.
- B. Clearly identify containers, bins and storage areas so that recyclable materials are separated from trash and can be transported to respective recycling facility for processing.
- C. Hazardous wastes shall be separated, stored, disposed of according to local, state, federal regulations.

3.2 DISPOSAL

- A. Contractor shall be responsible for transporting and disposing of materials that cannot be delivered to a source-separated or mixed materials recycling facility to a transfer station or disposal facility that can accept the materials in accordance with state and federal regulations.
- B. Construction or demolition materials with no practical reuse or that cannot be salvaged or recycled shall be disposed of at a landfill or incinerator.

3.3 REPORT

- A. With each application for progress payment, submit a summary of construction and demolition debris diversion and disposal including beginning and ending dates of period covered.
- B. Quantify all materials diverted from landfill disposal through salvage or recycling during the period with the receiving parties, dates removed, transportation costs, weight tickets, manifests, invoices. Include the net total costs or savings for each salvaged or recycled material.
- C. Quantify all materials disposed of during the period with the receiving parties, dates removed, transportation costs, weight tickets, tipping fees, manifests and invoices. Include the net total costs for each disposal.

- - - E N D - - -

SECTION 01 91 00

GENERAL COMMISSIONING REQUIREMENTS

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This Section 01 91 00 GENERAL COMMISSIONING REQUIREMENTS shall form the basis of the construction phase commissioning process and procedures. The Commissioning Agent shall add, modify, and refine the commissioning procedures, as approved by the Department of Veterans Affairs (VA), to suit field conditions and actual manufacturer's equipment, incorporate test data and procedure results, and provide detailed scheduling for all commissioning tasks.
- B. Various sections of the project specifications require equipment startup, testing, and adjusting services. Requirements for startup, testing, and adjusting services specified in the Division 7, Division 21, Division 22, Division 23, Division 26, Division 27, Division 28, and Division 31 series sections of these specifications are intended to be provided in coordination with the commissioning services and are not intended to duplicate services. The Contractor shall coordinate the work required by individual specification sections with the commissioning services requirements specified herein.
- C. Where individual testing, adjusting, or related services are required in the project specifications and not specifically required by this commissioning requirements specification, the specified services shall be provided and copies of documentation, as required by those specifications shall be submitted to the VA and the Commissioning Agent to be indexed for future reference.
- D. Where training or educational services for VA are required and specified in other sections of the specifications, including but not limited to Division 7, Division 8, Division 21, Division 22, Division 23, Division 26, Division 27, Division 28, and Division 31 series sections of the specification, these services are intended to be provided in addition to the training and educational services specified herein.
- E. Commissioning is a systematic process of verifying that the building systems perform interactively according to the construction documents and the VA's operational needs. The commissioning process shall encompass and coordinate the system documentation, equipment startup,

control system calibration, testing and balancing, performance testing and training. Commissioning during the construction, and post-occupancy phases is intended to achieve the following specific objectives according to the contract documents:

1. Verify that the applicable equipment and systems are installed in accordance with the contract documents and according to the manufacturer's recommendations.
 2. Verify and document proper integrated performance of equipment and systems.
 3. Verify that Operations & Maintenance documentation is complete.
 4. Verify that all components requiring servicing can be accessed, serviced and removed without disturbing nearby components including ducts, piping, cabling or wiring.
 5. Verify that the VA's operating personnel are adequately trained to enable them to operate, monitor, adjust, maintain, and repair building systems in an effective and energy-efficient manner.
 6. Document the successful achievement of the commissioning objectives listed above.
- F. The commissioning process does not take away from or reduce the responsibility of the Contractor to provide a finished and fully functioning product.

1.2 CONTRACTUAL RELATIONSHIPS

- A. For this construction project, the Department of Veterans Affairs contracts with a Contractor to provide construction services. The contracts are administered by the VA Contracting Officer and the Resident Engineer as the designated representative of the Contracting Officer. On this project, the authority to modify the contract in any way is strictly limited to the authority of the Contracting Officer and the Resident Engineer.
- B. In this structure, only two contract parties are recognized and communications on contractual issues are strictly limited to VA Resident Engineer and the Contractor. It is the practice of the VA to require that communications between other parties to the contracts (Subcontractors and Vendors) be conducted through the Resident Engineer and Contractor. It is also the practice of the VA that communications between other parties of the project (Commissioning Agent and Architect/Engineer) be conducted through the Resident Engineer.

- C. Whole Building Commissioning is a process that relies upon frequent and direct communications, as well as collaboration between all parties to the construction process. By its nature, a high level of communication and cooperation between the Commissioning Agent and all other parties (Architects, Engineers, Subcontractors, Vendors, third party testing agencies, etc) is essential to the success of the Commissioning effort.
- D. With these fundamental practices in mind, the commissioning process described herein has been developed to recognize that, in the execution of the Commissioning Process, the Commissioning Agent must develop effective methods to communicate with every member of the construction team involved in delivering commissioned systems while simultaneously respecting the exclusive contract authority of the Contracting Officer and Resident Engineer. Thus, the procedures outlined in this specification must be executed within the following limitations:
1. No communications (verbal or written) from the Commissioning Agent shall be deemed to constitute direction that modifies the terms of any contract between the Department of Veterans Affairs and the Contractor.
 2. Commissioning Issues identified by the Commissioning Agent will be delivered to the Resident Engineer and copied to the designated Commissioning Representatives for the Contractor and subcontractors on the Commissioning Team for information only in order to expedite the communication process. These issues must be understood as the professional opinion of the Commissioning Agent and as suggestions for resolution.
 3. In the event that any Commissioning Issues and suggested resolutions are deemed by the Resident Engineer to require either an official interpretation of the construction documents or require a modification of the contract documents, the Contracting Officer or Resident Engineer will issue an official directive to this effect.
 4. All parties to the Commissioning Process shall be individually responsible for alerting the Resident Engineer of any issues that they deem to constitute a potential contract change prior to acting on these issues.
 5. Authority for resolution or modification of design and construction issues rests solely with the Contracting Officer or Resident

Engineer, with appropriate technical guidance from the Architect/Engineer and/or Commissioning Agent.

1.3 RELATED WORK

- A. Section 01 00 00 GENERAL REQUIREMENTS.
- B. Section 23 08 00 COMMISSIONING OF HVAC SYSTEMS. SYSTEMS.

1.4 SUMMARY

- A. This Section includes general requirements that apply to implementation of commissioning without regard to systems, subsystems, and equipment being commissioned.
- B. The commissioning activities have been developed to support the VA requirements to meet guidelines for Federal Leadership in Environmental, Energy, and Economic Performance.

1.5 DEFINITIONS

- A. Architect: Includes Architect identified in the Contract for Construction between the Department of Veterans Affairs and Contractor, plus consultant/design professionals responsible for design of fire suppression, plumbing, HVAC, controls for HVAC systems, electrical, communications, electronic safety and security, as well as other related systems.
- B. CxA: Commissioning Agent.
- C. Commissioning Plan: a document that is an overall plan that outlines the commissioning process, commissioning team responsibilities, schedule for commissioning activities, and commissioning documents.
- D. Commissioning Issue: a condition in the installation or function of a component, piece of equipment or system that affects the system operations, maintenance, and/or repair.
- E. Commissioning Observation: a condition in the installation or function of a component, piece of equipment or system that may not be in compliance with the Contract Documents, or may not be in compliance with the manufacturer's installation instruction, or may not be in compliance with generally accepted industry standards.
- F. Systems Functional Performance Test: a test, or tests, of the dynamic function and operation of equipment and systems using manual (direct observation) or monitoring methods. Systems Functional Performance Testing is the dynamic testing of systems (rather than just components) under full operation (e.g., the chiller pump is tested interactively with the chiller functions to see if the pump ramps up and down to

maintain the differential pressure setpoint). Systems are tested under various modes, such as during low cooling or heating loads, high loads, component failures, unoccupied, varying outside air temperatures, fire alarm, power failure, etc. The systems are run through all the control system's sequences of operation and components are verified to be responding as the sequences state. Traditional air or water test and balancing (TAB) is not Systems Functional Performance Testing, in the commissioning sense of the word. TAB's primary work is setting up the system flows and pressures as specified, while System Functional Performance Testing is verifying that the system has already been set up properly and is functioning in accordance with the Construction Documents. The Commissioning Agent develops the Systems Functional Performance Test Procedures in a sequential written form, coordinates, witnesses, and documents the actual testing. Systems Functional Performance Testing is performed by the Contractor. Systems Functional Performance Tests are performed after startups, control systems are complete and operational, TAB functions and Pre-Functional Checklists are complete.

G. System: A system is defined as the entire set of components, equipment, and subsystems which must be coordinated to work together during normal operation to produce results for which the system is designed. For example, air conditioning supply air is only one component of an entire system which provides comfort conditions for a building. Other related components are return air, exhaust air, steam supply, chilled water supply, refrigerant supply, hot water supply, controls and electrical service, etc. Another example of a system which involves several components of different disciplines is a boiler installation. Efficient and acceptable boiler operation depends upon the coordination and proper operation of the fuel supply, combustion air, controls, steam, feedwater supply, condensate return and other related components.

H. Pre-Functional Checklist: a list of items provided by the Commissioning Agent to the Contractor that require inspection and elementary component tests conducted to verify proper installation of equipment. Pre-Functional Checklists are primarily static inspections and procedures to prepare the equipment or system for initial operation (e.g., belt tension, oil levels OK, labels affixed, gages in place, sensors calibrated, etc.). However, some Pre-Functional Checklist

items entail simple testing of the function of a component, a piece of equipment or system (such as measuring the voltage imbalance on a three-phase pump motor of a chiller system). The term "Pre-Functional" refers to before Systems Functional Performance Testing. Pre-Functional Checklists augment and are combined with the manufacturer's startup checklist and the Contractor's Quality Control checklists.

I. Seasonal Functional Performance Testing: a test or tests that are deferred until the system will experience conditions closer to their design conditions.

J. VA: Includes the Contracting Officer, Resident Engineer, or other authorized representative of the Department of Veterans Affairs.

K. TAB: Testing, Adjusting, and Balancing.

L. CxM: Commissioning Manager

M. CxR: Commissioning Representative of the Contractor other than the CxM

N. OxA: Owners primary commissioning representative

1.6 SYSTEMS TO BE COMMISSIONED

A. Commissioning of a system or systems specified for this project is part of the construction process. Documentation and testing of these systems, as well as training of the VA's Operation and Maintenance personnel, is required in cooperation with the VA and the Commissioning Agent.

B. The following systems will be commissioned as part of this project: 1. HVAC (Division 23)

a. Air Handling Systems (including terminal units and energy recovery units)

b. Air Handling Systems (Fans, motors, Variable Speed Drives, cooling coils and control valves, heating coils and control valves, filters, dampers, safeties such as smoke detectors or freezestats and damper end switches, controls, gages, and vibration isolation).

c. Dehumidification Systems (Energy recovery devices - such as enthalpy wheels, fans, motors, Variable Speed Drives, cooling coils and control valves, heating coils and control valves, filters, dampers, safeties, controls, gages, and vibration isolation).

d. Chilled Water Systems (Chilled water pumps and motors, Variable Speed Drives, chiller motor/compressor, controls, instrumentation and safeties, isolation valves, blending valves, side stream water cleaners/scrubbers/filters).

- e. Exhaust Fans (Fan, motor, Variable Speed Drives, controls and safeties).
- f. Heating Hot Water System System (Boilers, controls, gages and instrumentation, safety relief valves, combustion burners/fans/motors, fuel delivery pumps and motors, flues).
- g. Pumps and Variable Speed Drives
- h. Direct Digital Control System (BACnet or similar Local Area Network (LAN), Operator Work Station hardware and software, building controller hardware and software, terminal unit controller hardware and software, all sequences of operation, system accuracy and response time).
- i. HVAC Water Treatment Systems (Closed circuits - including shot feeders and final water analysis, open circuits - including water analysis, chemical/biocide tanks, injection piping, chemical/biocide pumps and motors, controls, water meter, and automatic blowdown).

1.7 COMMISSIONING TEAM

A. Members Appointed by Contractor:

1. Commissioning Manager (CxM): The designated person, company, or entity that plans, schedules and coordinates the commissioning activities for the construction team.
2. Contractor's Commissioning Representative(s): Individual(s), each having authority to act on behalf of the entity he or she represents, explicitly organized to implement the commissioning process through coordinated actions. The commissioning team shall consist of, but not be limited to, representatives of Contractor, including Project Superintendent and subcontractors, installers, suppliers, and specialists deemed appropriate by the Department of Veterans Affairs (VA) and Commissioning Agent.

B. Members Appointed by VA:

1. Commissioning Agent: The designated person, company, or entity that plans, schedules, and coordinates the commissioning team to implement the commissioning process. The VA will engage the CxA under a separate contract.
2. Representatives of the facility user and operation and maintenance personnel.
3. Architect and engineering design professionals.

1.8 VA'S COMMISSIONING RESPONSIBILITIES

- A. Appoint an individual, company or firm to act as the Commissioning Agent.
- B. Assign operation and maintenance personnel and schedule them to participate in commissioning team activities including, but not limited to, the following:
 - 1. Coordination meetings.
 - 2. Training in operation and maintenance of systems, subsystems, and equipment.
 - 3. Testing meetings.
 - 4. Witness and assist in Systems Functional Performance Testing.
 - 5. Demonstration of operation of systems, subsystems, and equipment.
- C. Provide the Construction Documents, prepared by Architect and approved by VA, to the Commissioning Agent and for use in managing the commissioning process, developing the commissioning plan, systems manuals, and reviewing the operation and maintenance training plan.

1.9 CONTRACTOR'S COMMISSIONING RESPONSIBILITIES

- A. The Contractor shall assign a Commissioning Manager to manage commissioning activities of the Contractor, and subcontractors. See section 23 08 00 for specific CxM responsibilities.
- B. The Contractor shall ensure that the commissioning responsibilities outlined in these specifications are included in all subcontracts and that subcontractors comply with the requirements of these specifications.
- C. The Contractor shall ensure that each installing subcontractor shall assign representatives with expertise and authority to act on behalf of the subcontractor and schedule them to participate in and perform commissioning team activities including, but not limited to, the following:
 - 1. Participate in commissioning coordination meetings.
 - 2. Conduct operation and maintenance training sessions in accordance with approved training plans.
 - 3. Verify that Work is complete and systems are operational according to the Contract Documents, including calibration of instrumentation and controls.
 - 4. Evaluate commissioning issues and commissioning observations identified in the Commissioning Issues Log, field reports, test reports or other commissioning documents. In collaboration with

entity responsible for system and equipment installation, recommend corrective action.

5. Review and comment on commissioning documentation.
6. Participate in meetings to coordinate Systems Functional Performance Testing.
7. Provide schedule for operation and maintenance data submittals, equipment startup, and testing to Commissioning Agent for incorporation into the commissioning plan.
8. Provide information to the Commissioning Agent for developing commissioning plan.
9. Participate in training sessions for VA's operation and maintenance personnel.
10. Provide technicians who are familiar with the construction and operation of installed systems and who shall develop specific test procedures to conduct Systems Functional Performance Testing of installed systems.

1.10 COMMISSIONING AGENT'S RESPONSIBILITIES

- A. Organize and lead the commissioning team.
- B. Prepare the commissioning plan. See Paragraph 1.11-A of this specification Section for further information.
- C. Review and comment on selected submittals from the Contractor for general conformance with the Construction Documents. Review and comment on the ability to test and operate the system and/or equipment, including providing gages, controls and other components required to operate, maintain, and test the system. Review and comment on performance expectations of systems and equipment and interfaces between systems relating to the Construction Documents.
- D. At the beginning of the construction phase, conduct an initial construction phase coordination meeting for the purpose of reviewing the commissioning activities and establishing tentative schedules for operation and maintenance submittals; operation and maintenance training sessions; TAB Work; Pre-Functional Checklists, Systems Functional Performance Testing; and project completion.
- E. Convene commissioning team meetings for the purpose of coordination, communication, and conflict resolution; discuss status of the commissioning processes. Responsibilities include arranging for facilities, preparing agenda and attendance lists, and notifying participants. The Commissioning Agent shall prepare and distribute

- minutes to commissioning team members and attendees within five workdays of the commissioning meeting.
- F. Observe construction and report progress, observations and issues. Observe systems and equipment installation for adequate accessibility for maintenance and component replacement or repair, and for general conformance with the Construction Documents.
 - G. Prepare Project specific Pre-Functional Checklists and Systems Functional Performance Test procedures.
 - H. Coordinate Systems Functional Performance Testing schedule with the Contractor.
 - I. Witness selected systems startups.
 - J. Verify selected Pre-Functional Checklists completed and submitted by the Contractor.
 - K. Witness and document Systems Functional Performance Testing.
 - L. Compile test data, inspection reports, and certificates and include them in the systems manual and commissioning report.
 - M. Review and comment on operation and maintenance (O&M) documentation and systems manual outline for compliance with the Contract Documents. Operation and maintenance documentation requirements are specified in Paragraph 1.25, Section 01 00 00 GENERAL REQUIREMENTS.
 - N. Review operation and maintenance training program developed by the Contractor. Verify training plans provide qualified instructors to conduct operation and maintenance training.
 - O. Prepare commissioning Field Observation Reports.
 - P. Prepare the Final Commissioning Report.
 - Q. Return to the site at 10 months into the 12 month warranty period and review with facility staff the current building operation and the condition of outstanding issues related to the original and seasonal Systems Functional Performance Testing. Also interview facility staff and identify problems or concerns they have operating the building as originally intended. Make suggestions for improvements and for recording these changes in the O&M manuals. Identify areas that may come under warranty or under the original construction contract. Assist facility staff in developing reports, documents and requests for services to remedy outstanding problems.
 - R. Assemble the final commissioning documentation, including the Final Commissioning Report and Addendum to the Final Commissioning Report.

1.11 COMMISSIONING DOCUMENTATION

- A. Commissioning Plan: A document, prepared by Commissioning Agent, that outlines the schedule, allocation of resources, and documentation requirements of the commissioning process, and shall include, but is not limited, to the following:
1. Plan for delivery and review of submittals, systems manuals, and other documents and reports. Identification of the relationship of these documents to other functions and a detailed description of submittals that are required to support the commissioning processes. Submittal dates shall include the latest date approved submittals must be received without adversely affecting commissioning plan.
 2. Description of the organization, layout, and content of commissioning documentation (including systems manual) and a detailed description of documents to be provided along with identification of responsible parties.
 3. Identification of systems and equipment to be commissioned.
 4. Schedule of Commissioning Coordination meetings.
 5. Identification of items that must be completed before the next operation can proceed.
 6. Description of responsibilities of commissioning team members.
 7. Description of observations to be made.
 8. Description of requirements for operation and maintenance training.
 9. Schedule for commissioning activities with dates coordinated with overall construction schedule.
 10. Process and schedule for documenting changes on a continuous basis to appear in Project Record Documents.
 11. Process and schedule for completing prestart and startup checklists for systems, subsystems, and equipment to be verified and tested.
 12. Preliminary Systems Functional Performance Test procedures.
- B. Systems Functional Performance Test Procedures: The Commissioning Agent will develop Systems Functional Performance Test Procedures for each system to be commissioned, including subsystems, or equipment and interfaces or interlocks with other systems. Systems Functional Performance Test Procedures will include a separate entry, with space for comments, for each item to be tested. Preliminary Systems Functional Performance Test Procedures will be provided to the VA, Architect/Engineer, and Contractor for review and comment. The Systems Performance Test Procedure will include test procedures for each mode

of operation and provide space to indicate whether the mode under test responded as required. Each System Functional Performance Test procedure, regardless of system, subsystem, or equipment being tested, shall include, but not be limited to, the following:

1. Name and identification code of tested system.
2. Test number.
3. Time and date of test.
4. Indication of whether the record is for a first test or retest following correction of a problem or issue.
5. Dated signatures of the person performing test and of the witness, if applicable.
6. Individuals present for test.
7. Observations and Issues.
8. Issue number, if any, generated as the result of test.

C. Pre-Functional Checklists: The Commissioning Agent will prepare *Pre-Functional Checklists*. *Pre-Functional Checklists shall be completed* and signed by the Contractor, verifying that systems, subsystems, equipment, and associated controls are ready for testing. The Commissioning Agent will spot check *Pre-Functional Checklists* to verify accuracy and readiness for testing. Inaccurate or incomplete *Pre-Functional Checklists* shall be returned to the Contractor for correction and resubmission.

D. Test and Inspection Reports: The Commissioning Agent will record test data, observations, and measurements on Systems Functional Performance Test Procedure. The report will also include recommendation for system acceptance or non-acceptance. Photographs, forms, and other means appropriate for the application shall be included with data. Commissioning Agent Will compile test and inspection reports and test and inspection certificates and include them in systems manual and commissioning report.

E. Corrective Action Documents: The Commissioning Agent will document corrective action taken for systems and equipment that fail tests. The documentation will include any required modifications to systems and equipment and/or revisions to test procedures, if any. The Commissioning Agent will witness and document any retesting of systems and/or equipment requiring corrective action and document retest results. The contractor will be responsible for cost incurred for retesting, see section 23 08 00.

F. Commissioning Issues Log: The Commissioning Agent will prepare and maintain Commissioning Issues Log that describes Commissioning Issues and Commissioning Observations that are identified during the Commissioning process. These observations and issues include, but are not limited to, those that are at variance with the Contract Documents. The Commissioning Issues Log will identify and track issues as they are encountered, the party responsible for resolution, progress toward resolution, and document how the issue was resolved. The Master Commissioning Issues Log will also track the status of unresolved issues.

1. Creating an Commissioning Issues Log Entry:

- a. Identify the issue with unique numeric or alphanumeric identifier by which the issue may be tracked.
- b. Assign a descriptive title for the issue.
- c. Identify date and time of the issue.
- d. Identify test number of test being performed at the time of the observation, if applicable, for cross reference.
- e. Identify system, subsystem, and equipment to which the issue applies.
- f. Identify location of system, subsystem, and equipment.
- g. Include information that may be helpful in diagnosing or evaluating the issue.
- h. Note recommended corrective action.
- i. Identify commissioning team member responsible for corrective action.
- j. Identify expected date of correction.
- k. Identify person that identified the issue.

2. Documenting Issue Resolution:

- a. Log date correction is completed or the issue is resolved.
- b. Describe corrective action or resolution taken. Include description of diagnostic steps taken to determine root cause of the issue, if any.
- c. Identify changes to the Contract Documents that may require action.
- d. State that correction was completed and system, subsystem, and equipment are ready for retest, if applicable.
- e. Identify person(s) who corrected or resolved the issue.
- f. Identify person(s) verifying the issue resolution.

G. Final Commissioning Report: The Commissioning Agent will document results of the commissioning process, including unresolved issues, and performance of systems, subsystems, and equipment. The Commissioning Report will indicate whether systems, subsystems, and equipment have been properly installed and are performing according to the Contract Documents. This report will be used by the Department of Veterans Affairs when determining that systems will be accepted. This report will be used to evaluate systems, subsystems, and equipment and will serve as a future reference document during VA occupancy and operation. It shall describe components and performance that exceed requirements of the Contract Documents and those that do not meet requirements of the Contract Documents. The commissioning report will include, but is not limited to, the following:

1. Lists and explanations of substitutions; compromises; variances with the Contract Documents; record of conditions; and, if appropriate, recommendations for resolution. Design Narrative documentation maintained by the Commissioning Agent.
2. Commissioning plan.
3. Pre-Functional Checklists completed by the Contractor, with annotation of the Commissioning Agent review and spot check.
4. Systems Functional Performance Test Procedures, with annotation of test results and test completion.
5. Commissioning Issues Log.
6. Listing of deferred and off season test(s) not performed, including the schedule for their completion.

H. Addendum to Final Commissioning Report: The Commissioning Agent will prepare an Addendum to the Final Commissioning Report near the end of the Warranty Period. The Addendum will indicate whether systems, subsystems, and equipment are complete and continue to perform according to the Contract Documents. The Addendum to the Final Commissioning Report shall include, but is not limited to, the following:

1. Documentation of deferred and off season test(s) results.
2. Completed Systems Functional Performance Test Procedures for off season test(s).
3. Documentation that unresolved system performance issues have been resolved.

4. Updated Commissioning Issues Log, including status of unresolved issues.
 5. Identification of potential Warranty Claims to be corrected by the Contractor.
- I. Systems Manual: The Commissioning Manager will gather required information and compile the Systems Manual under the direction of the CxA. The Systems Manual will include, but is not limited to, the following:
1. Design Narrative, including system narratives, schematics, single-line diagrams, flow diagrams, equipment schedules, and changes made throughout the Project.
 2. Reference to Final Commissioning Plan.
 3. Reference to Final Commissioning Report.
 4. Approved Operation and Maintenance Data as submitted by the Contractor.

1.12 SUBMITTALS

- A. Preliminary Commissioning Plan Submittal: The Commissioning Agent has prepared a Preliminary Commissioning Plan based on the final Construction Documents. The Preliminary Commissioning Plan is included as an Appendix to this specification section. The Preliminary Commissioning Plan is provided for information only. It contains preliminary information about the following commissioning activities:
1. The Commissioning Team: A list of commissioning team members by organization.
 2. Systems to be commissioned. A detailed list of systems to be commissioned for the project. This list also provides preliminary information on systems/equipment submittals to be reviewed by the Commissioning Agent; preliminary information on Pre-Functional Checklists that are to be completed; preliminary information on Systems Performance Testing, including information on testing sample size (where authorized by the VA).
 3. Commissioning Team Roles and Responsibilities: Preliminary roles and responsibilities for each Commissioning Team member.
 4. Commissioning Documents: A preliminary list of commissioning-related documents, include identification of the parties responsible for preparation, review, approval, and action on each document.

5. Commissioning Activities Schedule: Identification of Commissioning Activities, including Systems Functional Testing, the expected duration and predecessors for the activity.
 6. Pre-Functional Checklists: Preliminary Pre-Functional Checklists for equipment, components, subsystems, and systems to be commissioned. These Preliminary Pre-Functional Checklists provide guidance on the level of detailed information the Contractor shall include on the final submission.
 7. Systems Functional Performance Test Procedures: Preliminary step-by-step System Functional Performance Test Procedures to be used during Systems Functional Performance Testing. These Preliminary Systems Functional Performance procedures provide information on the level of testing rigor, and the level of Contractor support required during performance of system's testing.
- B. Final Commissioning Plan Submittal: Based on the Final Construction Documents and the Contractor's project team, the Commissioning Agent will prepare the Final Commissioning Plan as described in this section. The Commissioning Agent will submit three hard copies and three sets of electronic files of Final Commissioning Plan. The Contractor shall review the Commissioning Plan and provide any comments to the VA. The Commissioning Agent will incorporate review comments into the Final Commissioning Plan as directed by the VA.
- C. Systems Functional Performance Test Procedure: The Commissioning Agent will submit preliminary Systems Functional Performance Test Procedures to the Contractor, and the VA for review and comment. The Contractor shall return review comments to the VA and the Commissioning Agent. The VA will also return review comments to the Commissioning Agent. The Commissioning Agent will incorporate review comments into the Final Systems Functional Test Procedures to be used in Systems Functional Performance Testing.
- D. Pre-Functional Checklists: The Commissioning Agent will submit Pre-Functional Checklists to be completed by the Contractor.
- E. Test and Inspection Reports: The Commissioning Agent will submit test and inspection reports to the VA with copies to the Contractor and the Architect/Engineer.
- F. Corrective Action Documents: The Commissioning Agent will submit corrective action documents to the VA Resident Engineer with copies to the Contractor and Architect.

- G. Preliminary Commissioning Report Submittal: The Commissioning Agent will submit three electronic copies of the preliminary commissioning report. One electronic copy, with review comments, will be returned to the Commissioning Agent for preparation of the final submittal.
- H. Final Commissioning Report Submittal: The Commissioning Agent will submit four sets of electronically formatted information of the final commissioning report to the VA. The final submittal will incorporate comments as directed by the VA.
- I. Data for Commissioning:
1. The Commissioning Agent will request in writing from the Contractor specific information needed about each piece of commissioned equipment or system to fulfill requirements of the Commissioning Plan.
 2. The Commissioning Agent may request further documentation as is necessary for the commissioning process or to support other VA data collection requirements, including Construction Operations Building Information Exchange (COBIE), Building Information Modeling (BIM), etc.

1.13 COMMISSIONING PROCESS

- A. The Commissioning Agent will be responsible for the overall management of the commissioning process as well as coordinating scheduling of commissioning tasks with the VA and the Contractor. As directed by the VA, the Contractor shall incorporate Commissioning tasks, including, but not limited to, Systems Functional Performance Testing (including predecessors) with the Master Construction Schedule.
- B. Within 30 days of contract award, the Contractor shall designate a specific individual as the Commissioning Manager (CM) to manage and lead the commissioning effort on behalf of the Contractor. The Commissioning Manager shall be the single point of contact and communications for all commissioning related services by the Contractor.
- C. Within 30 days of contract award, the Contractor shall ensure that each subcontractor designates specific individuals as Commissioning Representatives (CR) to be responsible for commissioning related tasks. The Contractor shall ensure the designated Commissioning Representatives participate in the commissioning process as team members providing commissioning testing services, equipment operation, adjustments, and corrections if necessary. The Contractor shall ensure

that all Commissioning Representatives shall have sufficient authority to direct their respective staff to provide the services required, and to speak on behalf of their organizations in all commissioning related contractual matters.

1.14 QUALITY ASSURANCE

- A. Instructor Qualifications: Factory authorized service representatives shall be experienced in training, operation, and maintenance procedures for installed systems, subsystems, and equipment.
- B. Test Equipment Calibration: The Contractor shall comply with test equipment manufacturer's calibration procedures and intervals. Recalibrate test instruments immediately whenever instruments have been repaired following damage or dropping. Affix calibration tags to test instruments. Instruments shall have been calibrated within six months prior to use.

1.15 COORDINATION

- A. Management: The Commissioning Agent will coordinate the commissioning activities with the VA and Contractor. The Commissioning Agent will submit commissioning documents and information to the VA. All commissioning team members shall work together to fulfill their contracted responsibilities and meet the objectives of the contract documents.
- B. Scheduling: The Contractor will work with the Commissioning Agent and the VA to incorporate the commissioning activities into the construction schedule. The Commissioning Agent will provide sufficient information on commissioning activities to allow the Contractor and the VA to schedule commissioning activities. All parties shall address scheduling issues and make necessary notifications in a timely manner in order to expedite the project and the commissioning process. The Contractor shall update the Master Construction as directed by the VA.
- C. Initial Schedule of Commissioning Events: The Commissioning Agent will provide the initial schedule of primary commissioning events in the Commissioning Plan and at the commissioning coordination meetings. The Commissioning Plan will provide a format for this schedule. As construction progresses, more detailed schedules will be developed by the Contractor with information from the Commissioning Agent.
- D. Commissioning Coordinating Meetings: The Commissioning Agent will conduct periodic Commissioning Coordination Meetings of the commissioning team to review status of commissioning activities, to

discuss scheduling conflicts, and to discuss upcoming commissioning process activities.

- E. Pretesting Meetings: The Commissioning Agent will conduct pretest meetings of the commissioning team to review startup reports, Pre-Functional Checklist results, Systems Functional Performance Testing procedures, testing personnel and instrumentation requirements.
- F. Systems Functional Performance Testing Coordination: The Contractor shall coordinate testing activities to accommodate required quality assurance and control services with a minimum of delay and to avoid necessity of removing and replacing construction to accommodate testing and inspecting. The Contractor shall coordinate the schedule times for tests, inspections, obtaining samples, and similar activities.

PART 2 - PRODUCTS

2.1 TEST EQUIPMENT

- A. The Contractor shall provide all standard and specialized testing equipment required to perform Systems Functional Performance Testing. Test equipment required for Systems Functional Performance Testing will be identified in the detailed System Functional Performance Test Procedure prepared by the Commissioning Agent.
- B. Data logging equipment and software required to test equipment shall be provided by the Contractor.
- C. All testing equipment shall be of sufficient quality and accuracy to test and/or measure system performance with the tolerances specified in the Specifications. If not otherwise noted, the following minimum requirements apply: Temperature sensors and digital thermometers shall have a certified calibration within the past year to an accuracy of 0.5 °C (1.0 °F) and a resolution of + or - 0.1 °C (0.2 °F). Pressure sensors shall have an accuracy of + or - 2.0% of the value range being measured (not full range of meter) and have been calibrated within the last year. All equipment shall be calibrated according to the manufacturer's recommended intervals and when dropped or damaged. Calibration tags shall be affixed or certificates readily available.

PART 3 - EXECUTION

3.1 STARTUP, INITIAL CHECKOUT, AND PRE-FUNCTIONAL CHECKLISTS

- A. The following procedures shall apply to all equipment and systems to be commissioned, according to Part 1, Systems to Be Commissioned.
 - 1. Pre-Functional Checklists are important to ensure that the equipment and systems are hooked up and operational. These ensure that Systems

Functional Performance Testing may proceed without unnecessary delays. Each system to be commissioned shall have a full Pre-Functional Checklist completed by the Contractor prior to Systems Functional Performance Testing. No sampling strategies are used.

- a. The Pre-Functional Checklist will identify the trades responsible for completing the checklist. The Contractor shall ensure the appropriate trades complete the checklists.
 - b. The Commissioning Agent will review completed Pre-Functional Checklists and field-verify the accuracy of the completed checklist using sampling techniques.
2. Startup and Initial Checkout Plan: The Contractor shall develop detailed startup plans for all equipment. The primary role of the Contractor in this process is to ensure that there is written documentation that each of the manufacturer recommended procedures have been completed. Parties responsible for startup shall be identified in the Startup Plan and in the checklist forms.
- a. The Contractor shall develop the full startup plan by combining (or adding to) the checklists with the manufacturer's detailed startup and checkout procedures from the O&M manual data and the field checkout sheets normally used by the Contractor. The plan shall include checklists and procedures with specific boxes or lines for recording and documenting the checking and inspections of each procedure and a summary statement with a signature block at the end of the plan.
 - b. The full startup plan shall at a minimum consist of the following items:
 - 1) The Pre-Functional Checklists.
 - 2) The manufacturer's standard written startup procedures copied from the installation manuals with check boxes by each procedure and a signature block added by hand at the end.
 - 3) The manufacturer's normally used field checkout sheets.
 - a) The Commissioning Agent will submit the full startup plan to the VA and Contractor for review. Final approval will be by the VA.
 - b) The Contractor shall review and evaluate the procedures and the format for documenting them, noting any procedures that need to be revised or added.
3. Sensor and Actuator Calibration

- a. All field installed temperature, relative humidity, CO₂ and pressure sensors and gages, and all actuators (dampers and valves) on all equipment shall be calibrated using the methods described in Division 21, Division 22, Division 23, Division 26, Division 27, and Division 28 specifications.
 - b. All procedures used shall be fully documented on the Pre-Functional Checklists or other suitable forms, clearly referencing the procedures followed and written documentation of initial, intermediate and final results.
4. Execution of Equipment Startup
- a. Four weeks prior to equipment startup, the Contractor shall schedule startup and checkout with the VA and Commissioning Agent. The performance of the startup and checkout shall be directed and executed by the Contractor.
 - b. The Commissioning Agent will observe the startup procedures for selected pieces of primary equipment.
 - c. The Contractor shall execute startup and provide the VA and Commissioning Agent with a signed and dated copy of the completed startup checklists, and contractor tests.
 - d. Only individuals that have direct knowledge and witnessed that a line item task on the Startup Checklist was actually performed shall initial or check that item off. It is not acceptable for witnessing supervisors to fill out these forms.

3.2 DEFICIENCIES, NONCONFORMANCE, AND APPROVAL IN CHECKLISTS AND STARTUP

- A. The Contractor shall clearly list any outstanding items of the initial startup and Pre-Functional Checklist procedures that were not completed successfully, at the bottom of the procedures form or on an attached sheet. The procedures form and any outstanding deficiencies shall be provided to the VA and the Commissioning Agent within two days of completion.
- B. The Commissioning Agent will review the report and submit comments to the VA. The Commissioning Agent will work with the Contractor to correct and verify deficiencies or uncompleted items. The Commissioning Agent will involve the VA and others as necessary. The Contractor shall correct all areas that are noncompliant or incomplete in the checklists in a timely manner, and shall notify the VA and Commissioning Agent as soon as outstanding items have been corrected. The Contractor shall submit an updated startup report and a Statement of Correction on the

original noncompliance report. When satisfactorily completed, the Commissioning Agent will recommend approval of the checklists and startup of each system to the VA.

- C. The Contractor shall be responsible for resolution of deficiencies as directed the VA.

3.3 PHASED COMMISSIONING

- A. The project may require startup and initial checkout to be executed in phases. This phasing shall be planned and scheduled in a coordination meeting of the VA, Commissioning Agent, and the Contractor. Results will be added to the master construction schedule and the commissioning schedule.

3.4 TRENDING AND ALARMS

- A. Trending is a method of testing as a standalone method or to augment manual testing. The Contractor shall trend any and all points of the system or systems at intervals specified below.
- B. Alarms are a means to notify the system operator that abnormal conditions are present in the system. Alarms shall be structured into three tiers - Critical, Priority, and Maintenance.
 1. Critical alarms are intended to be alarms that require the immediate attention of and action by the Operator. These alarms shall be displayed on the Operator Workstation in a popup style window that is graphically linked to the associated unit's graphical display. The popup style window shall be displayed on top of any active window within the screen, including non DDC system software.
 2. Priority level alarms are to be printed to a printer which is connected to the Operator's Work Station located within the engineer's office. Additionally Priority level alarms shall be able to be monitored and viewed through an active alarm application. Priority level alarms are alarms which shall require reaction from the operator or maintenance personnel within a normal work shift, and not immediate action.
 3. Maintenance alarms are intended to be minor issues which would require examination by maintenance personnel within the following shift. These alarms shall be generated in a scheduled report automatically by the DDC system at the start of each shift. The generated maintenance report will be printed to a printer located within the engineer's office.

- C. The Contractor shall provide a wireless internet network in the building for use during controls programming, checkout, and commissioning. This network will allow project team members to more effectively program, view, manipulate and test control devices while being in the same room as the controlled device.
- D. The Contractor shall provide graphical trending through the DDC control system of systems being commissioned. Trending requirements are indicated below and included with the Systems Functional Performance Test Procedures. Trending shall occur before, during and after Systems Functional Performance Testing. The Contractor shall be responsible for producing graphical representations of the trended DDC points that show each system operating properly during steady state conditions as well as during the System Functional Testing. These graphical reports shall be submitted to the Resident Engineer and Commissioning Agent for review and analysis before, during dynamic operation, and after Systems Functional Performance Testing. The Contractor shall provide, but not limited to, the following trend requirements and trend submissions:
1. Pre-testing, Testing, and Post-testing - Trend reports of trend logs and graphical trend plots are required as defined by the Commissioning Agent. The trend log points, sampling rate, graphical plot configuration, and duration will be dictated by the Commissioning Agent. At any time during the Commissioning Process the Commissioning Agent may recommend changes to aspects of trending as deemed necessary for proper system analysis. The Contractor shall implement any changes as directed by the Resident Engineer. Any pre-test trend analysis comments generated by the Commissioning Team should be addressed and resolved by the Contractor, as directed by the Resident Engineer, prior to the execution of Systems Functional Performance Testing.
 2. Dynamic plotting - The Contractor shall also provide dynamic plotting during Systems Functional Performance testing at frequent intervals for points determined by the Systems Functional Performance Test Procedure. The graphical plots will be formatted and plotted at durations listed in the Systems Functional Performance Test Procedure.
 3. Graphical plotting - The graphical plots shall be provided with a dual y-axis allowing 15 or more trend points (series) plotted simultaneously on the graph with each series in distinct color. The

plots will further require title, axis naming, legend etc. all described by the Systems Functional Performance Test Procedure. If this cannot be sufficiently accomplished directly in the Direct Digital Control System then it is the responsibility of the Contractor to plot these trend logs in Microsoft Excel.

4. The following tables indicate the points to be trended and alarmed by system. The Operational Trend Duration column indicates the trend duration for normal operations. The Testing Trend Duration column indicates the trend duration prior to Systems Functional Performance Testing and again after Systems Functional Performance Testing. The Type column indicates point type: AI = Analog Input, AO = Analog Output, DI = Digital Input, DO = Digital Output, Calc = Calculated Point. In the Trend Interval Column, COV = Change of Value. The Alarm Type indicates the alarm priority; C = Critical, P = Priority, and M = Maintenance. The Alarm Range column indicates when the point is considered in the alarm state. The Alarm Delay column indicates the length of time the point must remain in an alarm state before the alarm is recorded in the DDC. The intent is to allow minor, short-duration events to be corrected by the DDC system prior to recording an alarm.

4-Pipe Fan Coil Trending and Alarms							
Point	Type	Trend Interval	Operational Trend Duration	Testing Trend Duration	Alarm Type	Alarm Range	Alarm Delay
Space Temperature	AI	15 Minutes	12 hours	3 days	P	$\pm 5^{\circ}\text{F}$ from SP	10 min
SA Temperature	AI	15 Minutes	12 hours	3 days	P	$\pm 5^{\circ}\text{F}$ from SP	10 min
Pre-Filter Status	AI	None	None	None	M	> SP	1 hour
Water Sensor	DI	COV	12 hours	3 days	M	N/A	30 Min
Cooling Coil Valve Position	AO	15 Minutes	12 hours	3 days	N/A		
Heating coil Valve Position	AO	15 Minutes	12 hours	3 days	N/A		

4-Pipe Fan Coil Trending and Alarms							
Point	Type	Trend Interval	Operational Trend Duration	Testing Trend Duration	Alarm Type	Alarm Range	Alarm Delay
Fan Coil ON/OFF	DO	COV	12 hours	3 days	M	Status <> Command	30
Chilled Water System Trending and Alarms							
Point	Type	Trend Interval	Operational Trend Duration	Testing Trend Duration	Alarm Type	Alarm Range	Alarm Delay
Chiller 1 Entering Temperature	AI	15 Minutes	12 Hours	3 days	N/A		
Chiller 1 Leaving Temperature	AI	15 Minutes	12 Hours	3 days	P	±5°F from SP	10 Min
Chiller 1 Flow	AI	15 Minutes	12 Hours	3 days	N/A		
Chiller 1 Percent Load	AI	15 Minutes	12 Hours	3 days	N/A		
Chiller 1 KW Consumption	AI	15 Minutes	12 Hours	3 days	N/A		
Chiller 1 Tonnage	AI	15 Minutes	12 Hours	3 days	N/A		
Chiller 2 Entering Temperature	AI	15 Minutes	12 Hours	3 days	N/A		
Chiller 2 Leaving Temperature	AI	15 Minutes	12 Hours	3 days	P	±5°F from SP	10 Min
Chiller 2 Flow	AI	15 Minutes	12 Hours	3 days	N/A		
Chiller 2 Percent Load	AI	15 Minutes	12 Hours	3 days	N/A		
Chiller 2 KW Consumption	AI	15 Minutes	12 Hours	3 days	N/A		
Chiller 2 Tonnage	AI	15 Minutes	12 Hours	3 days	N/A		
Primary Loop Decoupler Flow	AI	15 Minutes	12 Hours	3 days	N/A		
Primary Loop Flow	AI	15 Minutes	12 Hours	3 days	N/A		
Primary Loop Supply Temperature	AI	15 Minutes	12 Hours	3 days	N/A		
Secondary Loop Differential Pressure	AI	15 Minutes	12 Hours	3 days	P	±5% from SP	10 Min

4-Pipe Fan Coil Trending and Alarms							
Point	Type	Trend Interval	Operational Trend Duration	Testing Trend Duration	Alarm Type	Alarm Range	Alarm Delay
Secondary Loop Flow	AI	15 Minutes	12 Hours	3 days	N/A		
Secondary Loop Supply Temperature	AI	15 Minutes	12 Hours	3 days	N/A		
Secondary Loop Return Temperature	AI	15 Minutes	12 Hours	3 days	N/A		
Secondary Loop Tonnage	AI	15 Minutes	12 Hours	3 days	N/A		
Primary Loop Pump 1 Status	DI	COV	12 Hours	3 days	C	Status <> Command	30 min
Primary Loop Pump 2 Status	DI	COV	12 Hours	3 days	C	Status <> Command	30 min
Secondary Loop Pump 1 Status	DI	COV	12 Hours	3 days	C	Status <> Command	30 min
Secondary Loop Pump 2 Status	DI	COV	12 Hours	3 days	C	Status <> Command	30
Chiller 1 Status	DI	COV	12 Hours	3 days	C	Status <> Command	30 min
Chiller 1 Evaporator Iso-Valve	DI	COV	12 Hours	3 days	N/A		
Chiller 1 Evaporator Flow Switch	DI	COV	12 Hours	3 days	N/A		
Chiller 1 Unit Alarm	DI	COV	12 Hours	3 days	C	True	10 Min
Chiller 2 Status	DI	COV	12 Hours	3 days	C	Status <> Command	30 min
Chiller 2 Evaporator Iso-Valve	DI	COV	12 Hours	3 days	N/A		
Chiller 2 Evaporator Flow Switch	DI	COV	12 Hours	3 days	N/A		
Chiller 2 Unit Alarm	DI	COV	12 Hours	3 days	C	True	10 Min
Refrigerant Detector	DI	COV	12 Hours	3 days	C	True	10 Min

4-Pipe Fan Coil Trending and Alarms							
Point	Type	Trend Interval	Operational Trend Duration	Testing Trend Duration	Alarm Type	Alarm Range	Alarm Delay
Refrigerant Exhaust Fan Status	DI	COV	12 Hours	3 days	M	Status <> Command	30
Emergency Shutdown	DI	COV	12 Hours	3 days	P	True	1 Min
Primary Loop Pump 1 VFD Speed	AO	15 Minutes	12 Hours	3 days	N/A		
Primary Loop Pump 2 VFD Speed	AO	15 Minutes	12 Hours	3 days	N/A		
Secondary Loop Pump 1 VFD Speed	AO	15 Minutes	12 Hours	3 days	N/A		
Secondary Loop Pump 2 VFD Speed	AO	15 Minutes	12 Hours	3 days	N/A		
Primary Pump 1 Start / Stop	DO	COV	12 Hours	3 days	N/A		
Primary Pump 2 Start / Stop	DO	COV	12 Hours	3 days	N/A		
Secondary Pump 1 Start / Stop	DO	COV	12 Hours	3 days	N/A		
Secondary Pump 2 Start / Stop	DO	COV	12 Hours	3 days	N/A		
Chiller 1 ^{En} -DO able		COV	12 Hours	3 days	N/A		
Chiller 1 Iso-Valve Command	DO	COV	12 Hours	3 days	N/A		
Chiller 2 ^{En} -DO able		COV	12 Hours	3 days	N/A		
Chiller 2 Iso-Valve Command	DO	COV	12 Hours	3 days	N/A		
Refrigerant Exhaust Fan Start / Stop	DO	COV	12 Hours	3 days	N/A		

Hot Water Boiler System Trending and Alarms							
Point	Type	Trend Interval	Operational Trend Duration	Testing Trend Duration	Alarm Type	Alarm Range	Alarm Delay
Outside Air Temperature	AI	15 Minutes	12 Hours	3 days	N/A		
Boiler 1 Fire Signal	AI	15 Minutes	12 Hours	3 days	N/A		
Boiler 1 Entering Water Temperature	AI	15 Minutes	12 Hours	3 days	N/A		
Boiler 1 Leaving Water Temperature	AI	15 Minutes	12 Hours	3 days	N/A		
Boiler 2 Fire Signal	AI	15 Minutes	12 Hours	3 days	N/A		
Boiler 2 Entering Water Temperature	AI	15 Minutes	12 Hours	3 days	N/A		
Boiler 2 Leaving Water Temperature	AI	15 Minutes	12 Hours	3 days	N/A		
Hot Water Supply Temperature	AI	15 Minutes	12 Hours	3 days	P	±5 °F from SP	10 Min
Hot Water Return Temperature	AI	15 Minutes	12 Hours	3 days	N/A		
Secondary Loop Differential Pressure	AI	15 Minutes	12 Hours	3 days	C	±5% from SP	10 Min
Lead Boiler	AI	15 Minutes	12 Hours	3 days	N/A		
Boiler 1 ^{En} -DI able		COV	12 Hours	3 days	N/A		
Boiler 1 Status	DI	COV	12 Hours	3 days	P	Status <> Command	10 min
Boiler 1 Iso-DI lation Valve		COV	12 Hours	3 days	N/A		
Boiler 1 on Fuel Oil	DI	COV	12 Hours	3 days	N/A		
Boiler 1 Alarm	DI	COV	12 Hours	3 days	C	True	1 Min
Boiler 2 Enable	DI	COV	12 Hours	3 days	N/A		
Boiler 2 Status	DI	COV	12 Hours	3 days	P	Status <> Command	10 min
Boiler 2 Iso-DI lation Valve		COV	12 Hours	3 days	N/A		

Hot Water Boiler System Trending and Alarms							
Point	Type	Trend Interval	Operational Trend Duration	Testing Trend Duration	Alarm Type	Alarm Range	Alarm Delay
Boiler 2 on Fuel Oil	DI	COV	12 Hours	3 days	N/A		
Boiler 2 Alarm	DI	COV	12 Hours	3 days	C	True	1 Min
Combustion Dampers Open	DI	COV	12 Hours	3 days	P	Status <> Command	10 min
Primary Pump 1 Status	DI	COV	12 Hours	3 days	P	Status <> Command	10 min
Primary Pump 2 Status	DI	COV	12 Hours	3 days	P	Status <> Command	10 min
Secondary Pump 1 Status	DI	COV	12 Hours	3 days	P	Status <> Command	10 min
Secondary Pump 2 Status	DI	COV	12 Hours	3 days	P	Status <> Command	10 min
Primary Pump 1 VFD Speed	AO	COV	12 Hours	3 days	N/A		
Primary Pump 2 VFD Speed	AO	COV	12 Hours	3 days	N/A		
Secondary Pump 1 VFD Speed	AO	COV	12 Hours	3 days	N/A		
Secondary Pump 2 VFD Speed	AO	COV	12 Hours	3 days	N/A		
Hot Water System Enable	DO	COV	12 Hours	3 days	N/A		
Combustion Dampers Command	DO	COV	12 Hours	3 days	N/A		
Primary Pump 1 Start / Stop	DO	COV	12 Hours	3 days	N/A		
Primary Pump 2 Start / Stop	DO	COV	12 Hours	3 days	N/A		
Secondary Pump 1 Start / Stop	DO	COV	12 Hours	3 days	N/A		
Secondary Pump 2 Start / Stop	DO	COV	12 Hours	3 days	N/A		

E. The Contractor shall provide the following information prior to Systems Functional Performance Testing. Any documentation that is modified after submission shall be recorded and resubmitted to the Resident Engineer and Commissioning Agent.

1. Point-to-Point checkout documentation;
2. Sensor field calibration documentation including system name, sensor/point name, measured value, DDC value, and Correction Factor.
3. A sensor calibration table listing the referencing the location of procedures to following in the O&M manuals, and the frequency at which calibration should be performed for all sensors, separated by system, subsystem, and type. The calibration requirements shall be submitted both in the O&M manuals and separately in a standalone document containing all sensors for inclusion in the commissioning documentation. The following table is a sample that can be used as a template for submission.

SYSTEM		
Sensor	Calibration Frequency	O&M Calibration Procedure Reference
Discharge air temperature	Once a year	Volume I Section D.3.aa
Discharge static pressure	Every 6 months	Volume II Section A.1.c

4. Loop tuning documentation and constants for each loop of the building systems. The documentation shall be submitted in outline or table separated by system, control type (e.g. heating valve temperature control); proportional, integral and derivative constants, interval (and bias if used) for each loop. The following table is a sample that can be used as a template for submission.

AIR HANDLING UNIT AHU-1				
Control Reference	Proportional Constant	Integral Constant	Derivative Constant	Interval
Heating Valve Output	1000	20	10	2 sec.

3.5 SYSTEMS FUNCTIONAL PERFORMANCE TESTING

A. This paragraph applies to Systems Functional Performance Testing of systems for all referenced specification Divisions.

B. Objectives and Scope: The objective of Systems Functional Performance Testing is to demonstrate that each system is operating according to the Contract Documents. Systems Functional Performance Testing facilitates bringing the systems from a state of substantial completion to full dynamic operation. Additionally, during the testing process, areas of noncompliant performance are identified and corrected, thereby improving the operation and functioning of the systems. In general, each system shall be operated through all modes of operation (seasonal, occupied, unoccupied, warm-up, cool-down, part- and full-load, fire alarm and emergency power) where there is a specified system response. The Contractor shall verify each sequence in the sequences of operation. Proper responses to such modes and conditions as power failure, freeze condition, low oil pressure, no flow, equipment failure, etc. shall also be tested.

C. Development of Systems Functional Performance Test Procedures: Before Systems Functional Performance Test procedures are written, the Contractor shall submit all requested documentation and a current list of change orders affecting equipment or systems, including an updated points list, program code, control sequences and parameters. Using the testing parameters and requirements found in the Contract Documents and approved submittals and shop drawings, the Commissioning Agent will develop specific Systems Functional Test Procedures to verify and document proper operation of each piece of equipment and system to be commissioned. The Contractor shall assist the Commissioning Agent in developing the Systems Functional Performance Test procedures as requested by the Commissioning Agent i.e. by answering questions about equipment, operation, sequences, etc. Prior to execution, the Commissioning Agent will provide a copy of the Systems Functional Performance Test procedures to the VA, the Architect/Engineer, and the Contractor, who shall review the tests for feasibility, safety, equipment and warranty protection.

D. Purpose of Test Procedures: The purpose of each specific Systems Functional Performance Test is to verify and document compliance with the stated criteria of acceptance given on the test form. Representative test formats and examples are found in the Commissioning Plan for this project. (The Commissioning Plan is issued as a separate document and is available for review.) The test procedure forms

developed by the Commissioning Agent will include, but not be limited to, the following information:

1. System and equipment or component name(s)
 2. Equipment location and ID number
 3. Unique test ID number, and reference to unique Pre-Functional Checklists and startup documentation, and ID numbers for the piece of equipment.
 4. Date
 5. Project name
 6. Participating parties
 7. A copy of the specification section describing the test requirements
 8. A copy of the specific sequence of operations or other specified parameters being verified
 9. Formulas used in any calculations
 10. Required pretest field measurements
 11. Instructions for setting up the test.
 12. Special cautions, alarm limits, etc.
 13. Specific step-by-step procedures to execute the test, in a clear, sequential and repeatable format
 14. Acceptance criteria of proper performance with a Yes / No check box to allow for clearly marking whether or not proper performance of each part of the test was achieved.
 15. A section for comments.
 16. Signatures and date block for the Commissioning Agent. A place for the Contractor to initial to signify attendance at the test.
- E. Test Methods: Systems Functional Performance Testing shall be achieved by manual testing (i.e. persons manipulate the equipment and observe performance) and/or by monitoring the performance and analyzing the results using the control system's trend log capabilities or by standalone data loggers. The Contractor and Commissioning Agent shall determine which method is most appropriate for tests that do not have a method specified.
1. Simulated Conditions: Simulating conditions (not by an overwritten value) shall be allowed, although timing the testing to experience actual conditions is encouraged wherever practical.
 2. Overwritten Values: Overwriting sensor values to simulate a condition, such as overwriting the outside air temperature reading in a control system to be something other than it really is, shall

be allowed, but shall be used with caution and avoided when possible. Such testing methods often can only test a part of a system, as the interactions and responses of other systems will be erroneous or not applicable. Simulating a condition is preferable. e.g., for the above case, by heating the outside air sensor with a hair blower rather than overwriting the value or by altering the appropriate setpoint to see the desired response. Before simulating conditions or overwriting values, sensors, transducers and devices shall have been calibrated.

3. Simulated Signals: Using a signal generator which creates a simulated signal to test and calibrate transducers and DDC constants is generally recommended over using the sensor to act as the signal generator via simulated conditions or overwritten values.

4. Altering Setpoints: Rather than overwriting sensor values, and when simulating conditions is difficult, altering setpoints to test a sequence is acceptable. For example, to see the Air Conditioning compressor lockout initiate at an outside air temperature below 12 C (54 F), when the outside air temperature is above 12 C (54 F), temporarily change the lockout setpoint to be 2 C (4 F) above the current outside air temperature.

5. Indirect Indicators: Relying on indirect indicators for responses or performance shall be allowed only after visually and directly verifying and documenting, over the range of the tested parameters, that the indirect readings through the control system represent actual conditions and responses. Much of this verification shall be completed during systems startup and initial checkout.

F. Setup: Each function and test shall be performed under conditions that simulate actual conditions as closely as is practically possible. The Contractor shall provide all necessary materials, system modifications, etc. to produce the necessary flows, pressures, temperatures, etc. necessary to execute the test according to the specified conditions. At completion of the test, the Contractor shall return all affected building equipment and systems, due to these temporary modifications, to their pretest condition.

G. Sampling: No sampling is allowed in completing Pre-Functional Checklists. Sampling is allowed for Systems Functional Performance Test Procedures execution. The Commissioning Agent will determine the sampling rate. If at any point, frequent failures are occurring and

testing is becoming more troubleshooting than verification, the Commissioning Agent may stop the testing and require the Contractor to perform and document a checkout of the remaining units, prior to continuing with Systems Functional Performance Testing of the remaining units.

H. Cost of Retesting: The cost associated with expanded sample System Functional Performance Tests shall be solely the responsibility of the Contractor. Any required retesting by the Contractor shall not be considered a justified reason for a claim of delay or for a time extension by the Contractor.

I. Coordination and Scheduling: The Contractor shall provide a minimum of 7 days notice to the Commissioning Agent and the VA regarding the completion schedule for the Pre-Functional Checklists and startup of all equipment and systems. The Commissioning Agent will schedule Systems Functional Performance Tests with the Contractor and VA. The Commissioning Agent will witness and document the Systems Functional Performance Testing of systems. The Contractor shall execute the tests in accordance with the Systems Functional Performance Test Procedure.

J. Testing Prerequisites: In general, Systems Functional Performance Testing will be conducted only after Pre-Functional Checklists have been satisfactorily completed. The control system shall be sufficiently tested and approved by the Commissioning Agent and the VA before it is used to verify performance of other components or systems. The air balancing and water balancing shall be completed before Systems Functional Performance Testing of air-related or water-related equipment or systems are scheduled. Systems Functional Performance Testing will proceed from components to subsystems to systems. When the proper performance of all interacting individual systems has been achieved, the interface or coordinated responses between systems will be checked.

K. Problem Solving: The Commissioning Agent will recommend solutions to problems found, however the burden of responsibility to solve, correct and retest problems is with the Contractor.

3.6 DOCUMENTATION, NONCONFORMANCE AND APPROVAL OF TESTS

A. Documentation: The Commissioning Agent will witness, and document the results of all Systems Functional Performance Tests using the specific procedural forms developed by the Commissioning Agent for that purpose. Prior to testing, the Commissioning Agent will provide these forms to

the VA and the Contractor for review and approval. The Contractor shall include the filled out forms with the O&M manual data.

- B. Nonconformance: The Commissioning Agent will record the results of the Systems Functional Performance Tests on the procedure or test form. All items of nonconformance issues will be noted and reported to the VA on Commissioning Field Reports and/or the Commissioning Master Issues Log.
1. Corrections of minor items of noncompliance identified may be made during the tests. In such cases, the item of noncompliance and resolution shall be documented on the Systems Functional Test Procedure.
 2. Every effort shall be made to expedite the systems functional Performance Testing process and minimize unnecessary delays, while not compromising the integrity of the procedures. However, the Commissioning Agent shall not be pressured into overlooking noncompliant work or loosening acceptance criteria to satisfy scheduling or cost issues, unless there is an overriding reason to do so by direction from the VA.
 3. As the Systems Functional Performance Tests progresses and an item of noncompliance is identified, the Commissioning Agent shall discuss the issue with the Contractor and the VA.
 4. When there is no dispute on an item of noncompliance, and the Contractor accepts responsibility to correct it:
 - a. The Commissioning Agent will document the item of noncompliance and the Contractor's response and/or intentions. The Systems Functional Performance Test then continues or proceeds to another test or sequence. After the day's work is complete, the Commissioning Agent will submit a Commissioning Field Report to the VA. The Commissioning Agent will also note items of noncompliance and the Contractor's response in the Master Commissioning Issues Log. The Contractor shall correct the item of noncompliance and report completion to the VA and the Commissioning Agent.
 - b. The need for retesting will be determined by the Commissioning Agent. If retesting is required, the Commissioning Agent and the Contractor shall reschedule the test and the test shall be repeated.
 5. If there is a dispute about item of noncompliance, regarding whether it is an item of noncompliance, or who is responsible:

- a. The item of noncompliance shall be documented on the test form with the Contractor's response. The item of noncompliance with the Contractor's response shall also be reported on a Commissioning Field Report and on the Master Commissioning Issues Log.
 - b. Resolutions shall be made at the lowest management level possible. Other parties are brought into the discussions as needed. Final interpretive and acceptance authority is with the Department of Veterans Affairs.
 - c. The Commissioning Agent will document the resolution process.
 - d. Once the interpretation and resolution have been decided, the Contractor shall correct the item of noncompliance, report it to the Commissioning Agent. The requirement for retesting will be determined by the Commissioning Agent. If retesting is required, the Commissioning Agent and the Contractor shall reschedule the test. Retesting shall be repeated until satisfactory performance is achieved.
- C. Cost of Retesting: The cost to retest a System Functional Performance Test shall be solely the responsibility of the Contractor. Any required retesting by the Contractor shall not be considered a justified reason for a claim of delay or for a time extension by the Contractor.
- D. Failure Due to Manufacturer Defect: If 10%, or three, whichever is greater, of identical pieces (size alone does not constitute a difference) of equipment fail to perform in compliance with the Contract Documents (mechanically or substantively) due to manufacturing defect, not allowing it to meet its submitted performance specifications, all identical units may be considered unacceptable by the VA. In such case, the Contractor shall provide the VA with the following:
1. Within one week of notification from the VA, the Contractor shall examine all other identical units making a record of the findings. The findings shall be provided to the VA within two weeks of the original notice.
 2. Within two weeks of the original notification, the Contractor shall provide a signed and dated, written explanation of the problem, cause of failures, etc. and all proposed solutions which shall include full equipment submittals. The proposed solutions shall not

significantly exceed the specification requirements of the original installation.

3. The VA shall determine whether a replacement of all identical units or a repair is acceptable.
 4. Two examples of the proposed solution shall be installed by the Contractor and the VA shall be allowed to test the installations for up to one week, upon which the VA will decide whether to accept the solution.
 5. Upon acceptance, the Contractor shall replace or repair all identical items, at their expense and extend the warranty accordingly, if the original equipment warranty had begun. The replacement/repair work shall proceed with reasonable speed beginning within one week from when parts can be obtained.
- E. Approval: The Commissioning Agent will note each satisfactorily demonstrated function on the test form. Formal approval of the Systems Functional Performance Test shall be made later after review by the Commissioning Agent and by the VA. The Commissioning Agent will evaluate each test and report to the VA using a standard form. The VA will give final approval on each test using the same form, and provide signed copies to the Commissioning Agent and the Contractor.

3.7 DEFERRED TESTING

- A. Unforeseen Deferred Systems Functional Performance Tests: If any Systems Functional Performance Test cannot be completed due to the building structure, required occupancy condition or other conditions, execution of the Systems Functional Performance Testing may be delayed upon approval of the VA. These Systems Functional Performance Tests shall be conducted in the same manner as the seasonal tests as soon as possible. Services of the Contractor to conduct these unforeseen Deferred Systems Functional Performance Tests shall be negotiated between the VA and the Contractor.
- B. Deferred Seasonal Testing: Deferred Seasonal Systems Functional Performance Tests are those that must be deferred until weather conditions are closer to the systems design parameters. The Commissioning Agent will review systems parameters and recommend which Systems Functional Performance Tests should be deferred until weather conditions more closely match systems parameters. The Contractor shall review and comment on the proposed schedule for Deferred Seasonal Testing. The VA will review and approve the schedule for Deferred

Seasonal Testing. Deferred Seasonal Systems Functional Performances Tests shall be witnessed and documented by the Commissioning Agent. Deferred Seasonal Systems Functional Performance Tests shall be executed by the Contractor in accordance with these specifications.

3.8 OPERATION AND MAINTENANCE TRAINING REQUIREMENTS

- A. Training Preparation Conference: Before operation and maintenance training, the Commissioning Agent will convene a training preparation conference to include VA's Resident Engineer, VA's Operations and Maintenance personnel, and the Contractor. The purpose of this conference will be to discuss and plan for Training and Demonstration of VA Operations and Maintenance personnel.
- B. The Contractor shall provide training and demonstration as required by other Division 21, Division 22, Division 23, Division 26, Division 27, Division 28, and Division 31 sections. The Training and Demonstration shall include, but is not limited to, the following:
1. Review the Contract Documents.
 2. Review installed systems, subsystems, and equipment.
 3. Review instructor qualifications.
 4. Review instructional methods and procedures.
 5. Review training module outlines and contents.
 6. Review course materials (including operation and maintenance manuals).
 7. Review and discuss locations and other facilities required for instruction.
 8. Review and finalize training schedule and verify availability of educational materials, instructors, audiovisual equipment, and facilities needed to avoid delays.
 9. For instruction that must occur outside, review weather and forecasted weather conditions and procedures to follow if conditions are unfavorable.
- C. Training Module Submittals: The Contractor shall submit the following information to the VA and the Commissioning Agent:
1. Instruction Program: Submit two copies of outline of instructional program for demonstration and training, including a schedule of proposed dates, times, length of instruction time, and instructors' names for each training module. Include learning objective and outline for each training module. At completion of training, submit two complete training manuals for VA's use.

2. Qualification Data: Submit qualifications for facilitator and/or instructor.
3. Attendance Record: For each training module, submit list of participants and length of instruction time.
4. Evaluations: For each participant and for each training module, submit results and documentation of performance-based test.
5. Demonstration and Training Videotapes: Submit two copies within seven days of end of each training module.
 - a. Identification: On each copy, provide an applied label with the following information:
 - 1) Name of Project.
 - 2) Name and address of photographer
 - 3) Name of Contractor.
 - 4) Date videotape was recorded.
 - 5) Description of vantage point, indicating location, direction (by compass point), and elevation or story of construction.
6. Transcript: Prepared on 8-1/2-by-11-inch paper, punched and bound in heavy-duty, 3-ring, vinyl-covered binders. Mark appropriate identification on front and spine of each binder. Include a cover sheet with same label information as the corresponding videotape. Include name of Project and date of videotape on each page.

D. QUALITY ASSURANCE

1. Facilitator Qualifications: A firm or individual experienced in training or educating maintenance personnel in a training program similar in content and extent to that indicated for this Project, and whose work has resulted in training or education with a record of successful learning performance.
2. Instructor Qualifications: A factory authorized service representative, complying with requirements in Division 01 Section "Quality Requirements," experienced in operation and maintenance procedures and training.
3. Photographer Qualifications: A professional photographer who is experienced photographing construction projects.

E. COORDINATION

1. Coordinate instruction schedule with VA's operations. Adjust schedule as required to minimize disrupting VA's operations.
2. Coordinate instructors, including providing notification of dates, times, length of instruction time, and course content.

3. Coordinate content of training modules with content of approved emergency, operation, and maintenance manuals. Do not submit instruction program until operation and maintenance data has been reviewed and approved by the VA.

F. INSTRUCTION PROGRAM

1. Program Structure: Develop an instruction program that includes individual training modules for each system and equipment not part of a system, as required by individual Specification Sections, and as follows:
 - a. Fire protection systems, including fire alarm, fire pumps, and fire suppression systems.
 - b. Intrusion detection systems.
 - c. Conveying systems, including elevators, wheelchair lifts, escalators, and automated materials handling systems.
 - d. Medical equipment, including medical gas equipment and piping.
 - e. Laboratory equipment, including laboratory air and vacuum equipment and piping.
 - f. Heat generation, including boilers, feedwater equipment, pumps, steam distribution piping, condensate return systems, heating hot water heat exchangers, and heating hot water distribution piping.
 - g. Refrigeration systems, including chillers, cooling towers, condensers, pumps, and distribution piping.
 - h. HVAC systems, including air handling equipment, air distribution systems, and terminal equipment and devices.
 - i. switchgear, transformers, switchboards, panelboards, uninterruptible power supplies, and motor controls.
 - j. Packaged engine generators, including synchronizing switchgear/switchboards, and transfer switches.
 - k. Lighting equipment and controls.
 - l. Communication systems, including intercommunication, surveillance, nurse call systems, public address, mass evacuation, voice and data, and entertainment television equipment.
 - m. Site utilities including lift stations, condensate pumping and return systems, and storm water pumping systems.

- G. Training Modules: Develop a learning objective and teaching outline for each module. Include a description of specific skills and

knowledge that participants are expected to master. For each module, include instruction for the following:

1. Basis of System Design, Operational Requirements, and Criteria: Include the following:
 - a. System, subsystem, and equipment descriptions.
 - b. Performance and design criteria if Contractor is delegated design responsibility.
 - c. Operating standards.
 - d. Regulatory requirements.
 - e. Equipment function.
 - f. Operating characteristics.
 - g. Limiting conditions.
 - h. Performance curves.
2. Documentation: Review the following items in detail:
 - a. Emergency manuals.
 - b. Operations manuals.
 - c. Maintenance manuals.
 - d. Project Record Documents.
 - e. Identification systems.
 - f. Warranties and bonds.
 - g. Maintenance service agreements and similar continuing commitments.
3. Emergencies: Include the following, as applicable:
 - a. Instructions on meaning of warnings, trouble indications, and error messages.
 - b. Instructions on stopping.
 - c. Shutdown instructions for each type of emergency.
 - d. Operating instructions for conditions outside of normal operating limits.
 - e. Sequences for electric or electronic systems.
 - f. Special operating instructions and procedures.
4. Operations: Include the following, as applicable:
 - a. Startup procedures.
 - b. Equipment or system break-in procedures.
 - c. Routine and normal operating instructions.
 - d. Regulation and control procedures.
 - e. Control sequences.
 - f. Safety procedures.

- g. Instructions on stopping.
 - h. Normal shutdown instructions.
 - i. Operating procedures for emergencies.
 - j. Operating procedures for system, subsystem, or equipment failure.
 - k. Seasonal and weekend operating instructions.
 - l. Required sequences for electric or electronic systems.
 - m. Special operating instructions and procedures.
5. Adjustments: Include the following:
- a. Alignments.
 - b. Checking adjustments.
 - c. Noise and vibration adjustments.
 - d. Economy and efficiency adjustments.
6. Troubleshooting: Include the following:
- a. Diagnostic instructions.
 - b. Test and inspection procedures.
7. Maintenance: Include the following:
- a. Inspection procedures.
 - b. Types of cleaning agents to be used and methods of cleaning.
 - c. List of cleaning agents and methods of cleaning detrimental to product.
 - d. Procedures for routine cleaning
 - e. Procedures for preventive maintenance.
 - f. Procedures for routine maintenance.
 - g. Instruction on use of special tools.
8. Repairs: Include the following:
- a. Diagnosis instructions.
 - b. Repair instructions.
 - c. Disassembly; component removal, repair, and replacement; and reassembly instructions.
 - d. Instructions for identifying parts and components.
 - e. Review of spare parts needed for operation and maintenance.
- H. Training Execution:
- 1. Preparation: Assemble educational materials necessary for instruction, including documentation and training module. Assemble training modules into a combined training manual. Set up instructional equipment at instruction location.
 - 2. Instruction:

- a. Facilitator: Engage a qualified facilitator to prepare instruction program and training modules, to coordinate instructors, and to coordinate between Contractor and Department of Veterans Affairs for number of participants, instruction times, and location.
 - b. Instructor: Engage qualified instructors to instruct VA's personnel to adjust, operate, and maintain systems, subsystems, and equipment not part of a system.
 - 1) The Commissioning Agent will furnish an instructor to describe basis of system design, operational requirements, criteria, and regulatory requirements.
 - 2) The VA will furnish an instructor to describe VA's operational philosophy.
 - 3) The VA will furnish the Contractor with names and positions of participants.
3. Scheduling: Provide instruction at mutually agreed times. For equipment that requires seasonal operation, provide similar instruction at start of each season. Schedule training with the VA and the Commissioning Agent with at least seven days' advance notice.
4. Evaluation: At conclusion of each training module, assess and document each participant's mastery of module by use of an oral, or a written, performance-based test.
5. Cleanup: Collect used and leftover educational materials and remove from Project site. Remove instructional equipment. Restore systems and equipment to condition existing before initial training use. I.
- Demonstration and Training Recording:
- 1. General: Engage a qualified commercial photographer to record demonstration and training. Record each training module separately. Include classroom instructions and demonstrations, board diagrams, and other visual aids, but not student practice. At beginning of each training module, record each chart containing learning objective and lesson outline.
 - 2. Video Format: Provide high quality color DVD color on standard size DVD disks.
 - 3. Recording: Mount camera on tripod before starting recording, unless otherwise necessary to show area of demonstration and training. Display continuous running time.

4. Narration: Describe scenes on videotape by audio narration by microphone while demonstration and training is recorded. Include description of items being viewed. Describe vantage point, indicating location, direction (by compass point), and elevation or story of construction.

----- END -----

**SECTION 02 41 00
DEMOLITION**

PART 1 - GENERAL

1.1 DESCRIPTION:

This section specifies demolition and removal of sidewalks, paving, landscaping, signage, utilities and debris from trash dumps shown.

1.2 RELATED WORK:

- A. Demolition and removal of roads, walks, curbs, and on-grade slabs outside buildings to be demolished: Section 31 20 11, EARTH MOVING (SHORT FORM).
- B. Safety Requirements: GENERAL CONDITIONS Article, ACCIDENT PREVENTION.
- C. Disconnecting utility services prior to demolition: Section 01 00 00, GENERAL REQUIREMENTS.
- D. Reserved items that are to remain the property of the Government: Section 01 00 00, GENERAL REQUIREMENTS.
- E. Environmental Protection: Section 01 57 19, TEMPORARY ENVIRONMENTAL CONTROLS.
- F. Construction Waste Management: Section 017419 CONSTRUCTION WASTE MANAGEMENT.
- G. Infectious Control: Section 01 00 00, GENERAL REQUIREMENTS, Article 1.7, INFECTION PREVENTION MEASURES.

1.3 PROTECTION:

- A. Perform demolition in such manner as to eliminate hazards to persons and property; to minimize interference with use of adjacent areas, utilities and structures or interruption of use of such utilities; and to provide free passage to and from such adjacent areas of structures. Comply with requirements of GENERAL CONDITIONS Article, ACCIDENT PREVENTION.
- B. Provide safeguards, including warning signs, barricades, temporary fences, warning lights, and other similar items that are required for protection of all personnel during demolition and removal operations. Comply with requirements of Section 01 00 00, GENERAL REQUIREMENTS, Article PROTECTION OF EXISTING VEGETATION, STRUCTURES, EQUIPMENT, UTILITIES AND IMPROVEMENTS.
- C. Maintain fences, barricades, lights, and other similar items around exposed excavations until such excavations have been completely filled.
- D. Provide enclosed dust chutes with control gates from each floor to carry debris to truck beds and govern flow of material into truck. Provide overhead bridges of tight board or prefabricated metal construction at dust chutes to protect persons and property from falling debris.

- E. Prevent spread of flying particles and dust. Sprinkle rubbish and debris with water to keep dust to a minimum. Do not use water if it results in hazardous or objectionable condition such as, but not limited to; ice, flooding, or pollution. Vacuum and dust the work area daily.
- F. Before beginning any demolition work, the Contractor shall survey the site and examine the drawings and specifications to determine the extent of the work. The contractor shall take necessary precautions to avoid damages to existing items to remain in place, to be reused, or to remain the property of the Medical Center; any damaged items shall be repaired or replaced as approved by the COTR. The Contractor shall coordinate the work of this section with all other work and shall construct and maintain shoring, bracing, and supports as required. The Contractor shall ensure that structural elements are not overloaded and shall be responsible for increasing structural supports or adding new supports as may be required as a result of any cutting, removal, or demolition work performed under this contract. Do not overload structural elements. Provide new supports and reinforcement for existing construction weakened by demolition or removal works. Repairs, reinforcement, or structural replacement must have COTR's approval.
- G. The work shall comply with the requirements of Section 01 57 19, TEMPORARY ENVIRONMENTAL CONTROLS.
- H. The work shall comply with the requirements of Section 01 00 00, GENERAL REQUIREMENTS, Article 1.7 INFECTION PREVENTION MEASURES.

1.4 UTILITY SERVICES:

- A. Demolish and remove outside utility service lines shown to be removed.
- B. Remove abandoned outside utility lines that would interfere with installation of new utility lines and new construction.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.1 DEMOLITION:

- A. Debris, including brick, concrete, metals and similar materials shall become property of Contractor and shall be disposed of by him daily, off the Medical Center to avoid accumulation at the demolition site. Materials that cannot be removed daily shall be stored in areas specified by the COTR. Break up concrete slabs below grade that do not require removal from present location into pieces not exceeding 600 mm (24 inches) square to permit drainage. Contractor shall dispose debris in compliance with applicable federal, state or local permits, rules and/or regulations.

- B. Remove and legally dispose of all materials, other than earth to remain as part of project work, from any trash dumps shown. Materials removed shall become property of contractor and shall be disposed of in compliance with applicable federal, state or local permits, rules and/or regulations. All materials in the indicated trash dump areas, including above surrounding grade and extending to a depth of 1500mm (5feet) below surrounding grade, shall be included as part of the lump sum compensation for the work of this section. Materials that are located beneath the surface of the surrounding ground more than 1500 mm (5 feet), or materials that are discovered to be hazardous, shall be handled as unforeseen. The removal of hazardous material shall be referred to Hazardous Materials specifications.
- C. Remove existing utilities as indicated or uncovered by work and terminate in a manner conforming to the nationally recognized code covering the specific utility and approved by the COTR. When Utility lines are encountered that are not indicated on the drawings, the COTR shall be notified prior to further work in that area.

3.2 CLEAN-UP:

On completion of work of this section and after removal of all debris, leave site in clean condition satisfactory to COTR. Clean-up shall include off the Medical Center disposal of all items and materials not required to remain property of the Government as well as all debris and rubbish resulting from demolition operations.

- - - E N D - - -

THIS PAGE INTENTIONALLY LEFT BLANK

SECTION 02 82 13.41
ASBESTOS ABATEMENT FOR TOTAL DEMOLITION PROJECTS

TABLE OF CONTENTS

<u>TITLE</u>	<u>PAGE</u>
1.1 SUMMARY OF THE WORK	1
1.1.1 CONTRACT DOCUMENTS AND RELATED REQUIREMENTS	1
1.1.2 EXTENT OF WORK	1
1.1.3 RELATED WORK	1
1.1.4 TASKS	2
1.1.5 ABATEMENT CONTRACTOR USE OF PREMISES	2
1.2 STOP ABATEMENT ORDER	2
1.3 DEFINITIONS	3
1.3.1 GENERAL	3
1.3.2 GLOSSARY:	3
1.3.3 REFERENCED STANDARDS ORGANIZATIONS:	9
1.4 APPLICABLE CODES AND REGULATIONS	10
1.4.1 GENERAL APPLICABILITY OF CODES, REGULATIONS, AND STANDARDS:	10
1.4.2 ABATEMENT CONTRACTOR RESPONSIBILITY:	10
1.4.3 FEDERAL REQUIREMENTS:	11
1.4.4 STATE REQUIREMENTS:	11
1.4.5 LOCAL REQUIREMENTS:	11
1.4.6 PERMITS/LICENSES:	11
1.4.7 POSTING AND FILING OF REGULATIONS:	11
1.4.8 VA RESPONSIBILITIES:	11
1.4.9 SITE SECURITY	12
1.4.10 EMERGENCY ACTION PLAN AND ARRANGEMENTS	12
1.4.11 ACCIDENT PREVENTION	13
1.4.12 PRE-construction MEETING	14
1.5 ABATEMENT PROJECT COORDINATION	15
1.5.1 PERSONNEL	15
1.6 WORKER PROTECTION	16
1.6.1 TRAINING OF ABATEMENT PERSONNEL	16
1.6.2 PERSONAL PROTECTIVE EQUIPMENT	16

1.7 RESPIRATORY PROTECTION	16
1.7.2 RESPIRATORY PROTECTION PROGRAM COORDINATOR	17
1.7.3 SELECTION AND USE OF RESPIRATORS	17
1.7.4 MINIMUM RESPIRATORY PROTECTION	17
1.7.6 RESPIRATOR FIT TEST	17
1.7.7 RESPIRATOR FIT CHECK	17
1.7.8 MAINTENANCE AND CARE OF RESPIRATORS:	18
1.7.9 SUPPLIED AIR SYSTEMS	18
1.8 WORKER PROTECTION	18
1.8.5 REGULATED AREA REQUIREMENTS	19
1.9 DECONTAMINATION FACILITIES	19
1.9.1 DESCRIPTION	19
1.9.3 TEMPORARY FACILITIES TO THE PDF and EWDF	20
1.9.3 PERSONNEL DECONTAMINATION FACILITY (PDF)	20
1.9.5 EQUIPMENT/WASTE DECONTAMINATION FACILITY (EWDF)	22
1.9.6 EQUIPMENT/WASTE DECONTAMINATION PROCEDURES:	23
PART 2 - PRODUCTS, MATERIALS AND EQUIPMENT	23
2.1 MATERIALS AND EQUIPMENT	23
2.21.1 GENERAL REQUIREMENTS (all abatement projects)	23
2.1.2 NEGATIVE PRESSURE FILTRATION SYSTEM	24
2.1.3 DESIGN AND LAYOUT	25
2.1.4 NEGATIVE AIR MACHINES (HEPA UNITS)	25
2.1.6 MONITORING	26
2.1.8 SUPPLEMENTAL MAKE-UP AIR INLETS	27
2.1.11 USE OF SYSTEM DURING ABATEMENT OPERATIONS	27
2.1.12 DISMANTLING THE SYSTEM	28
2.2 CONTAINMENT BARRIERS AND COVERINGS IN THE REGULATED AREA	28
2.2.1 GENERAL	28
2.2.2 PREPARATION PRIOR TO SEALING THE REGULATED AREA	28
2.2.3 CONTROLLING ACCESS TO THE REGULATED AREA	28
2.2.4 CRITICAL BARRIERS	29
2.2.5 PRIMARY BARRIERS	29
2.2.6 SECONDARY BARRIERS	29
2.2.7 EXTENSION OF THE REGULATED AREA	29
2.3 MONITORING, INSPECTION AND TESTING	30
2.3.1 GENERAL	30

2.3.2 SCOPE OF SERVICES OF THE VPIH CONSULTANT	31
2.3.3 MONITORING, INSPECTION AND TESTING BY CONTRACTOR CPIH/CIH	31
2.4 asbestos hazard abatement plan	32
2.5 SUBMITTALS	33
2.5.1 PRE-CONSTRUCTION MEETING SUBMITTALS	33
2.5.2 SUBMITTALS DURING ABATEMENT	35
2.5.3 SUBMITTALS AT COMPLETION OF ABATEMENT	35
PART 3 - EXECUTION	35
3.1 PRE-ABATEMENT ACTIVITIES	35
3.1.1 PRE-ABATEMENT MEETING	35
3.1.3 PRE-ABATEMENT CONSTRUCTION AND OPERATIONS	36
3.2 REGULATED AREA PREPARATIONS	37
3.3 CONTAINMENT COVERINGS FOR THE REGULATED AREA	37
3.3.3 CONTROLLING ACCESS TO THE REGULATED AREA	38
3.3.4 CRITICAL BARRIERS	38
3.3.5 PRIMARY/SECONDARY BARRIERS	38
3.3.6 EXTENSION OF THE REGULATED AREA	39
3.4 REMOVAL OF RACM AND ACE	39
3.4.1 WETTING MATERIALS	39
3.4.2 WET REMOVAL OF ACM OTHER THAN AMOSITE	39
3.4.3 WET REMOVAL OF AMOSITE	40
3.4.4 REMOVAL OF RACM CONTAMINATED SOIL AND OTHER SPECIAL PROCEDURES: ..	41
3.4.5 GLOVEBAG REMOVAL PROCEDURES	41
3.5 DISPOSAL OF RACM AND ACE WASTE MATERIALS	41
3.5.2 PROCEDURES	41
3.6 PROJECT DECONTAMINATION	42
3.6.1 GENERAL	42
3.6.3 WORK DESCRIPTION	42
3.6.4 PRE-DECONTAMINATION CONDITIONS	42
3.7 VISUAL INSPECTION AND AIR CLEARANCE TESTING	43
3.7.1 GENERAL	43
3.7.2 VISUAL INSPECTION	43
3.7.3 AIR CLEARANCE TESTING	43
3.7.4 AIR CLEARANCE PROCEDURES	43
3.7.5 CLEARANCE SAMPLING USING PCM	43
3.8 ABATEMENT CLOSEOUT AND CERTIFICATE OF COMPLIANCE	44

3.8.1 COMPLETION OF ABATEMENT WORK 44

3.8.3 WORK SHIFTS 44

ATTACHMENT #1 45

ATTACHMENT #2 46

ATTACHMENT #3 48

ATTACHMENT #4 49

PART 1 - GENERAL

1.1 SUMMARY OF THE WORK

1.1.1 CONTRACT DOCUMENTS AND RELATED REQUIREMENTS

Drawings, general provisions of the contract, including general and supplementary conditions, Asbestos Abatement, Demolition, Accident Prevention (FAR 52.236-13) and other Division 01, GENERAL REQUIREMENTS specifications, shall apply to the work of this section. Prevailing wage requirements pursuant to the Davis-Bacon Act shall apply to this work. The contract documents show the work to be done under the contract and related requirements and conditions impacting the project. Related requirements and conditions include applicable codes and regulations, notices and permits, existing site conditions and restrictions on use of the site, coordination with other work and the phasing of the work. In the event the Abatement Contractor discovers a conflict in the contract documents and/or requirements or codes, the conflict must be brought to the immediate attention of the Contracting Officer for resolution. Whenever there is a conflict or overlap in the requirements, the most stringent shall apply.

Any actions taken by the Abatement Contractor without obtaining guidance from the Contracting Officer shall become the sole risk and responsibility of the Abatement Contractor.

1.1.2 EXTENT OF WORK

- A. Contractor shall obtain a copy of the NESHAP inspection report from the COTR. This report will indicate the anticipated building components that will be required to be abated.
 1. In summary, regulated asbestos containing materials are anticipated to be found in the existing underground steam piping.
- B. This work will be asbestos abatement prior to the total demolition of the site as indicated by the scope of work. RACM discovered during site demolition and building construction is also within the scope of this specification. The extent of the abatement indicated in the NESHAP report is for informational purposes only and is based on the best information available at the time of the specification preparation. The Abatement Contractor shall satisfy themselves as to the extent of the work. Nothing in this section may be interpreted as limiting the extent of work otherwise required by this contract and related documents.
- C. Removal, clean-up and disposal of regulated asbestos containing materials (RACM) and asbestos contaminated elements shall be conducted in approved regulated areas in all areas prior to the beginning of demolition. Any RACM discovered during demolition activity shall be cause for stopping the work. The Demolition Contractor's personnel shall attend an on-site training session related to the types of asbestos at the site and shall not disturb the ACM if found during their work.

No abatement work shall begin in any area unless the Abatement Contractor/Competent Person/VA Representative agreed that all asbestos work requirements as stipulated in the specification have been met. Attachment #4 must be filled out for each abatement area.

1.1.3 TASKS

The work tasks are summarized briefly as follows:

- A. Asbestos abatement of RACM as required by EPA NESHAP prior to site demolition. An EPA/State certified Project Designer must provide a site-specific specification for the asbestos abatement.
- B. Asbestos abatement and clean-up of the asbestos containing debris as indicated in the scope of work. Pre-abatement activities including pre-abatement meeting(s), inspection(s), notifications, permits, submittal approvals, work-site preparation/isolation, accident prevention, emergency procedures arrangements, and standard operating procedures for asbestos abatement work.
- C. Demolition activities including demolition, clean-up and disposal of building materials, record keeping, security, monitoring, and inspections conducted in accordance with all applicable laws and this specification. A Demolition Plan, developed by a Professional Engineer, meeting the requirements of 29 CFR 1926.850(a) must be provided.

1.1.4 ABATEMENT CONTRACTOR USE OF PREMISES

- A. The Contractor and Contractor's personnel shall cooperate fully with the VA representative/consultant to facilitate efficient use of buildings and areas within buildings. The Contractor shall perform the work in accordance with the VA specifications, drawings, phasing plan and in compliance with any/all applicable Federal, State and Local regulations and requirements.
- B. The Contractor shall use the existing facilities in the building strictly within the limits indicated in contract documents as well as the approved VA Design and Construction Procedure. VA Design and Construction Procedure drawings of partially occupied buildings will show the limits of regulated areas; the placement of decontamination facilities; the temporary location of bagged waste ACM; the path of transport to outside the building; and the temporary waste storage area for each building/regulated area. Any variation from the arrangements shown on drawings shall be secured in writing from the VA representative through the pre-abatement plan of action.

1.2 STOP ABATEMENT ORDER

- A. If the Contracting Officer; their field representative; (the facility Safety Officer/Manager or their designee, or the VA Professional Industrial Hygienist/Certified Industrial Hygienist (VPIH/CIH) presents a verbal **Stop Asbestos Removal Order**, the Contractor/Personnel shall immediately stop all asbestos removal and maintain HEPA filtered negative pressure air flow in the containment and adequately wet any exposed ACM. If a verbal Stop Asbestos Removal Order is issued, the VA shall follow-up with a written order to the Contractor as soon as practicable. The Contractor shall not resume any asbestos removal activity until authorized to do so in writing by the VA Contracting Officer. A stop asbestos removal order may be issued at any time the VA Contracting Officer determines abatement conditions/activities are not within VA specification, regulatory requirements or that an imminent hazard exists to human health or the environment. Work stoppage will continue until conditions have been corrected to the satisfaction of the VA. Standby time and costs for corrective actions will be borne by the Contractor, including the VPIH/CIH time. The occurrence of any of

the following events shall be reported immediately by the Contractor's competent person to the VA Contracting Office or field representative using the most expeditious means (e.g., verbal or telephonic), followed up with written notification to the Contracting Officer as soon as it is practical. The Contractor shall immediately stop asbestos removal/disturbance activities and initiate fiber reduction activities:

- A. Airborne PCM analysis results equal to or greater than 0.01 f/cc outside a regulated area or >0.05 f/cc inside a regulated area;
- B. Breach or break in regulated area containment barrier(s);
- C. Less than -0.02" WCG pressure in the regulated area;
- D. Serious injury/death at the site;
- E. Fire/safety emergency at the site;
- F. Respiratory protection system failure;
- G. Power failure or loss of wetting agent; or
- H. Any visible emissions observed outside the regulated area.

1.3 DEFINITIONS

1.3.1 GENERAL

Definitions and explanations here are neither complete nor exclusive of all terms used in the contract documents, but are general for the work to the extent they are not stated more explicitly in another element of the contract documents. Drawings must be recognized as diagrammatic in nature and not completely descriptive of the requirements indicated therein.

1.3.2 GLOSSARY:

Abatement - Procedures to control fiber release from asbestos-containing materials. Includes removal, encapsulation, enclosure, demolition and renovation activities related to asbestos containing materials (ACM).

Aerosol - Solid or liquid particulate suspended in air.

Adequately wet - Sufficiently mixed or penetrated with liquid to prevent the release of particulates. If visible emissions are observed coming from the ACM, then that material has not been adequately wetted.

Aggressive method - Removal or disturbance of building material by sanding, abrading, grinding, or other method that breaks, crumbles, or disintegrates intact ACM.

Aggressive sampling - EPA AHERA defined clearance sampling method using air moving equipment such as fans and leaf blowers to aggressively disturb and maintain in the air residual fibers after abatement.

AHERA - Asbestos Hazard Emergency Response Act. Asbestos regulations for schools issued in 1987.

Aircell - Pipe or duct insulation made of corrugated cardboard which contains asbestos.

Air monitoring - The process of measuring the fiber content of a known volume of air collected over a specified period of time. The NIOSH 7400 Method, Issue 2 is used to determine the fiber levels in air.

For personal samples and clearance air testing using Phase Contrast Microscopy (PCM) analysis. NIOSH Method 7402 can be used when it is necessary to confirm fibers counted by PCM as being asbestos. The AHERA TEM analysis may be used for background, area samples and clearance samples when required by this specification, or at the discretion of the VPIH/CIH as appropriate.

Air sample filter - The filter used to collect fibers which are then counted. The filter is made of mixed cellulose ester membrane for PCM (Phase Contrast Microscopy) and polycarbonate for TEM (Transmission Electron Microscopy)

Amended water - Water to which a surfactant (wetting agent) has been added to increase the penetrating ability of the liquid.

Asbestos - Includes chrysotile, amosite, crocidolite, tremolite asbestos, anthophyllite asbestos, actinolite asbestos, and any of these minerals that have been chemically treated or altered. Asbestos also includes PACM, as defined below.

Asbestos Hazard Abatement Plan (AHAP) - Asbestos work procedures required to be submitted by the contractor before work begins. **Asbestos-containing material (ACM)** - Any material containing more than one percent of asbestos.

Asbestos contaminated elements (ACE) - Building elements such as ceilings, walls, lights, or ductwork that are contaminated with asbestos.

Asbestos-contaminated soil (ACS) - Soil found in the work area or in adjacent areas such as crawlspaces or pipe tunnels which is contaminated with asbestos-containing material debris and cannot be easily separated from the material.

Asbestos-containing waste (ACW) material - Asbestos-containing material or asbestos contaminated objects requiring disposal.

Asbestos Project Monitor - Some states require that any person conducting asbestos abatement clearance inspections and clearance air sampling be licensed as an asbestos project monitor.

Asbestos waste decontamination facility - A system consisting of drum/bag washing facilities and a temporary storage area for cleaned containers of asbestos waste. Used as the exit for waste and equipment leaving the regulated area. In an emergency, it may be used to evacuate personnel. **Authorized person** - Any person authorized by the VA, the Contractor, or government agency and required by work duties to be present in regulated areas.

Authorized visitor - Any person approved by the VA; the contractor; or any government agency representative having jurisdiction over the regulated area (e.g., OSHA, Federal and State EPA).

Barrier - Any surface that isolates the regulated area and inhibits fiber migration from the regulated area.

Containment Barrier - An airtight barrier consisting of walls, floors, and/or ceilings of sealed plastic sheeting which surrounds and seals the outer perimeter of the regulated area.

Critical Barrier - The barrier responsible for isolating the regulated area from adjacent spaces, typically constructed of plastic sheeting secured in place at openings such as doors, windows, or any other opening into the regulated area.

Primary Barrier - Plastic barriers placed over critical barriers and exposed directly to abatement work.

Secondary Barrier - Any additional plastic barriers used to isolate and provide protection from debris during abatement work.

Breathing zone - The hemisphere forward of the shoulders with a radius of about 150 - 225 mm (6 - 9 inches) from the worker's nose.

Bridging encapsulant - An encapsulant that forms a layer on the surface of the ACM.

Building/facility owner - The legal entity, including a lessee, which exercises control over management and recordkeeping functions relating to a building and/or facility in which asbestos activities take place.

Bulk testing - The collection and analysis of suspect asbestos containing materials.

Certified Industrial Hygienist (CIH) - A person certified in the comprehensive practice of industrial hygiene by the American Board of Industrial Hygiene.

Class I asbestos work - Activities involving the removal of Thermal System Insulation (TSI) and surfacing ACM and Presumed Asbestos Containing Material (PACM).

Class II asbestos work - Activities involving the removal of ACM which is not thermal system insulation or surfacing material. This includes, but is not limited to, the removal of asbestos-containing wallboard, floor tile and sheeting, roofing and siding shingles, and construction mastic.

Clean room/Changing room - An uncontaminated room having facilities for the storage of employee's street clothing and uncontaminated materials and equipment.

Clearance sample - The final air sample taken after all asbestos work has been done and visually inspected. Performed by the VA's professional industrial hygiene consultant/Certified Industrial Hygienist (VPIH/CIH).

Closely resemble - The major workplace conditions which have contributed to the levels of historic asbestos exposure, are no more protective than conditions of the current workplace.

Competent person - In addition to the definition in 29 CFR 1926.32(f), one who is capable of identifying existing asbestos hazards in the workplace and selecting the appropriate control strategy for asbestos exposure, who has the authority to take prompt corrective measures to eliminate them, as specified in 29 CFR 1926.32(f); in addition, for Class I and II work who is specially trained in a training course which meets the criteria of EPA's Model Accreditation Plan (40 CFR 763) for supervisor.

Contractor's Professional Industrial Hygienist (CPIH/CIH) - The asbestos abatement contractor's industrial hygienist. The industrial hygienist must meet the qualification requirements of a PIH and may be a certified industrial hygienist (CIH).

Count - Refers to the fiber count or the average number of fibers greater than five microns in length with a length-to-width (aspect) ratio of at least 3 to 1, per cubic centimeter of air.

Crawlspace - An area which can be found either in or adjacent to the work area. This area has limited access and egress and may contain asbestos materials and/or asbestos contaminated soil.

Decontamination area/unit - An enclosed area adjacent to and connected to the regulated area and consisting of an equipment room, shower room, and clean room, which is used for the decontamination of workers, materials, and equipment that are contaminated with asbestos.

Demolition - The wrecking or taking out of any load-supporting structural member and any related razing, removing, or stripping of asbestos products.

VA Total - means a building or substantial part of the building is completely removed, torn or knocked down, bulldozed, flattened, or razed, including removal of building debris.

Disposal bag - Typically 6 mil thick sift-proof, dustproof, leak-tight container used to package and transport asbestos waste from regulated areas to the approved landfill. Each bag/container must be labeled/marked in accordance with EPA, OSHA and DOT requirements.

Disturbance - Activities that disrupt the matrix of ACM or PACM, crumble or pulverize ACM or PACM, or generate visible debris from ACM or PACM.

Disturbance includes cutting away small amounts of ACM or PACM, no greater than the amount that can be contained in one standard sized glove bag or waste bag in order to access a building component. In no event shall the amount of ACM or PACM so disturbed exceed that which can be contained in one glove bag or disposal bag which shall not exceed 60 inches in length or width.

Drum - A rigid, impermeable container made of cardboard fiber, plastic, or metal which can be sealed in order to be sift-proof, dustproof, and leak-tight.

Employee exposure - The exposure to airborne asbestos that would occur if the employee were not wearing respiratory protection equipment.

Encapsulant - A material that surrounds or embeds asbestos fibers in an adhesive matrix and prevents the release of fibers.

Encapsulation - Treating ACM with an encapsulant.

Enclosure - The construction of an air tight, impermeable, permanent barrier around ACM to control the release of asbestos fibers from the material and also eliminate access to the material.

Equipment room - A contaminated room located within the decontamination area that is supplied with impermeable bags or containers for the disposal of contaminated protective clothing and equipment.

Fiber - A particulate form of asbestos, 5 microns or longer, with a length to width (aspect) ratio of at least 3 to 1.

Fibers per cubic centimeter (f/cc) - Abbreviation for fibers per cubic centimeter, used to describe the level of asbestos fibers in air.

Filter - Media used in respirators, vacuums, or other machines to remove particulate from air.

Firestopping - Material used to close the open parts of a structure in order to prevent a fire from spreading.

Friable asbestos containing material - Any material containing more than one (1) percent or asbestos as determined using the method specified in appendix A, Subpart F, 40 CFR 763, section 1, Polarized Light Microscopy, that, when dry, can be crumbled, pulverized, or reduced to powder by hand pressure.

Glovebag - Not more than a 60 x 60 inch impervious plastic bag-like enclosure affixed around an asbestos-containing material, with glove-like appendages through which materials and tools may be handled.

High efficiency particulate air (HEPA) filter - An ASHRAE MERV 17 filter capable of trapping and retaining at least 99.97 percent of all mono-dispersed particles of 0.3 micrometers in diameter.

HEPA vacuum - Vacuum collection equipment equipped with a HEPA filter system capable of collecting and retaining asbestos fibers.

Homogeneous area - An area of surfacing, thermal system insulation or miscellaneous ACM that is uniform in color, texture and date of application.

HVAC - Heating, Ventilation and Air Conditioning

Industrial hygienist (IH) - A professional qualified by education, training, and experience to anticipate, recognize, evaluate and develop controls for occupational health hazards. Meets definition requirements of the American Industrial Hygiene Association (AIHA).

Industrial hygienist technician (IH Technician) - A person working under the direction of an IH or CIH who has special training, experience, certifications and licenses required for the industrial hygiene work assigned. Some states require that an industrial hygienist technician

conducting asbestos abatement clearance inspection and clearance air sampling be licensed as an asbestos project monitor.

Intact - The ACM has not crumbled, been pulverized, or otherwise deteriorated so that the asbestos is no longer likely to be bound with its matrix.

Lockdown - Applying encapsulant, after a final visual inspection, on all abated surfaces at the conclusion of ACM removal prior to removal of critical barriers.

National Emission Standards for Hazardous Air Pollutants (NESHAP) - EPA's rule to control emissions of asbestos to the environment (40 CFR Part 61, Subpart M).

Negative initial exposure assessment - A demonstration by the employer which complies with the criteria in 29 CFR 1926.1101 (f)(2)(iii), that employee exposure during an operation is expected to be consistently below the PEL.

Negative pressure - Air pressure which is lower than the surrounding area, created by exhausting air from a sealed regulated area through HEPA equipped filtration units. OSHA requires maintaining -0.02" water column gauge inside the negative pressure enclosure.

Negative pressure respirator - A respirator in which the air pressure inside the facepiece is negative during inhalation relative to the air pressure outside the respirator facepiece.

Non-friable ACM - Material that contains more than 1 percent asbestos but cannot be crumbled, pulverized, or reduced to powder by hand pressure.

Organic vapor cartridge - The type of cartridge used on air purifying respirators to remove organic vapor hazardous air contaminants.

Outside air - The air outside buildings and structures, including, but not limited to, the air under a bridge or in an open ferry dock.

Owner/operator - Any person who owns, leases, operates, controls, or supervises the facility being demolished or renovated or any person who owns, leases, operates, controls, or supervises the demolition or renovation operation, or both.

Penetrating encapsulant - Encapsulant that is absorbed into the ACM matrix without leaving a surface layer.

Personal sampling/monitoring - Representative air samples obtained in the breathing zone for one or workers within the regulated area using a filter cassette and a calibrated air sampling pump to determine asbestos exposure.

Personal protective equipment (PPE) - equipment designed to protect user from injury and/or specific job hazard. Such equipment may include protective clothing, hard hats, safety glasses, and respirators.

Permissible exposure limit (PEL) - The level of exposure OSHA allows for an 8 hour time weighted average. For asbestos fibers, the eight (8) hour time weighted average PEL is 0.1 fibers per cubic centimeter (0.1 f/cc) of air and the 30-minute Excursion Limit is 1.0 fibers per cubic centimeter (1 f/cc).

Pipe tunnel - An area, typically located adjacent to mechanical spaces or boiler rooms in which the pipes servicing the heating system in the building are routed to allow the pipes to access heating elements. These areas may contain asbestos pipe insulation, asbestos fittings, or asbestos-contaminated soil.

Polarized light microscopy (PLM) - Light microscopy using dispersion staining techniques and refractive indices to identify and quantify the type(s) of asbestos present in a bulk sample.

Polyethylene sheeting - Strong plastic barrier material 4 to 6 mils thick, semi-transparent, flame retardant per NFPA 241.

Positive/negative fit check - A method of verifying the seal of a facepiece respirator by temporarily occluding the filters and breathing in (inhaling) and then temporarily occluding the exhalation valve and breathing out (exhaling) while checking for inward or outward leakage of the respirator respectively.

Presumed ACM (PACM) - Thermal system insulation, surfacing, and flooring material installed in buildings prior to 1981. If the building owner has actual knowledge, or should have known through the exercise of due diligence that other materials are ACM, they too must be treated as PACM. The designation of PACM may be rebutted pursuant to 29 CFR 1926.1101 (b).

Professional IH - An IH who meets the definition requirements of AIHA; meets the definition requirements of OSHA as a "Competent Person" at 29 CFR 1926.1101 (b); has completed two specialized EPA approved courses on management and supervision of asbestos abatement projects; has formal training in respiratory protection and waste disposal; and has a minimum of four projects of similar complexity with this project of which at least three projects serving as the supervisory IH. The PIH may be either the VA's PIH (VPIH) or Contractor's PIH (CPIH/CIH).

Project designer - A person who has successfully completed the training requirements for an asbestos abatement project designer as required by 40 CFR 763 Appendix C, Part I; (B)(5).

Assigned Protection factor - A value assigned by OSHA/NIOSH to indicate the expected protection provided by each respirator class, when the respirator is properly selected and worn correctly. The number indicates the reduction of exposure level from outside to inside the respirator facepiece.

Qualitative fit test (QLFT) - A fit test using a challenge material that can be sensed by the wearer if leakage in the respirator occurs.

Quantitative fit test (QNFT) - A fit test using a challenge material which is quantified outside and inside the respirator thus allowing the determination of the actual fit factor.

Regulated area - An area established by the employer to demarcate where Class I, II, III asbestos work is conducted, and any adjoining area where debris and waste from such asbestos work may accumulate; and a work area within which airborne concentrations of asbestos exceed, or there is a reasonable possibility they may exceed the PEL.

Regulated ACM (RACM) - Friable ACM; Category I non-friable ACM that has become friable; Category I non-friable ACM that will be or has been subjected to sanding, grinding, cutting, or abrading or; Category II non-friable ACM that has a high probability of becoming or has become crumbled, pulverized, or reduced to powder by the forces expected to act on the material in the course of the demolition or renovation operation.

Removal - All operations where ACM, PACM and/or RACM is taken out or stripped from structures or substrates, including demolition operations.

Renovation - Altering a facility or one or more facility components in any way, including the stripping or removal of asbestos from a facility component which does not involve demolition activity.

Repair - Overhauling, rebuilding, reconstructing, or reconditioning of structures or substrates, including encapsulation or other repair of ACM or PACM attached to structures or substrates.

Shower room - The portion of the PDF where personnel shower before leaving the regulated area.

Supplied air respirator (SAR) - A respiratory protection system that supplies minimum Grade D respirable air per ANSI/Compressed Gas Association Commodity Specification for Air, G-7.1-1989.

Surfacing ACM - A material containing more than 1 percent asbestos that is sprayed, troweled on or otherwise applied to surfaces for acoustical, fireproofing and other purposes.

Surfactant - A chemical added to water to decrease water's surface tension thus making it more penetrating into ACM.

Thermal system ACM - A material containing more than 1 percent asbestos applied to pipes, fittings, boilers, breeching, tanks, ducts, or other structural components to prevent heat loss or gain.

Transmission electron microscopy (TEM) - A microscopy method that can identify and count asbestos fibers.

VA Professional Industrial Hygienist (VPIH/CIH) - The Department of Veterans Affairs Professional Industrial Hygienist must meet the qualifications of a PIH, and may be a Certified Industrial Hygienist (CIH).

VA Representative - The VA official responsible for on-going project work.

Visible emissions - Any emissions, which are visually detectable without the aid of instruments, coming from ACM/PACM/RACM/ACS or ACM waste material.

Waste/Equipment decontamination facility (W/EDF) - The area in which equipment is decontaminated before removal from the regulated area.

Waste generator - Any owner or operator whose act or process produces asbestos-containing waste material.

Waste shipment record - The shipping document, required to be originated and signed by the waste generator, used to track and substantiate the disposition of asbestos-containing waste material. **Wet cleaning** - The process of thoroughly eliminating, by wet methods, any asbestos contamination from surfaces or objects.

SPEC WRITER NOTE: You may wish to add further definitions.

1.3.3 REFERENCED STANDARDS ORGANIZATIONS:

The following acronyms or abbreviations as referenced in contract/specification documents are defined to mean the associated names. Names and addresses may be subject to change.

- A. VA Department of Veterans Affairs
810 Vermont Avenue, NW
Washington, DC 20420
- B. CFR Code of Federal Regulations
Government Printing Office
Washington, DC 20420
- C. EPA Environmental Protection
Agency 401 M St., SW
Washington, DC 20460

202-382-3949

- D. MIL-STD Military Standards/Standardization Division
Office of the Assistant Secretary of Defense
Washington, DC 20420
- E. NEC National Electrical Code (by NFPA)
- F. NEMA National Electrical Manufacturer's Association
2101 L Street, N.W.
Washington, DC 20037
- G. NFPA National Fire Protection Association
1 Batterymarch Park
P.O. Box 9101
Quincy, MA 02269-9101
800-344-3555
- H. OSHA Occupational Safety and Health Administration
U.S. Department of Labor
Government Printing Office
Washington, DC 20402
- I. DOT Department of Transportation
Washington, DC 20590

1.4 APPLICABLE CODES AND REGULATIONS

1.4.1 GENERAL APPLICABILITY OF CODES, REGULATIONS, AND STANDARDS:

- A. All work under this contract shall be done in strict accordance with all applicable Federal, State, and local regulations, standards and codes governing asbestos abatement, and any other trade work done in conjunction with the abatement. All applicable codes, regulations and standards are adopted into this specification and will have the same force and effect as this specification.
- B. The most recent edition of any relevant regulation, standard, document or code shall be in effect. Where conflict among the requirements or with these specification exists, the most stringent requirement(s) shall be utilized.
- C. Copies of all standards, regulations, codes and other applicable documents, including this specification and those listed in Section 1.5 shall be available at the worksite in the Abatement Contractor's office area/clean room.

1.4.2 ABATEMENT CONTRACTOR RESPONSIBILITY:

The Asbestos Abatement Contractor (Contractor) shall assume full responsibility and liability for compliance with all applicable Federal, State and Local regulations related to any and all aspects of the asbestos abatement project. The Contractor is responsible for providing and maintaining training, accreditations, medical exams, medical records, personal protective equipment (PPE) including respiratory protection including respirator fit testing, as required by applicable Federal, State and Local regulations. The Contractor shall hold the VA and VPIH/CIH consultants harmless for any Contractor's

failure to comply with any applicable work, packaging, transporting, disposal, safety, health, or environmental requirement on the part of himself, his employees, or his subcontractors. The Contractor will incur all costs of the CPIH/CIH, including all sampling/analytical costs to assure compliance with OSHA/EPA/State requirements related to failure to comply with the regulations applicable to the work.

1.4.3 FEDERAL REQUIREMENTS:

Federal requirements which govern various aspects of asbestos abatement include, but are not limited to, the following regulations:

- A. Occupational Safety and Health Administration (OSHA)
 - 1. Title 29 CFR 1926 - Construction Standard Requirements - Demolition Work
 - 2. Title 29 CFR 1910.38(a);(b) - Emergency Action Plan
 - 3. Title 29 CFR 1910.132 - Personal Protective Equipment
 - 4. Title 29 CFR 1910.20 - Access to Employee Exposure and Medical Records
 - 5. Title 29 CFR 1910.1200 - Hazard Communication
 - 6. Title 29 CFR 1910.151 - Medical and First Aid
- B. Environmental Protection Agency (EPA)
 - 1. Title 40 CFR 61 Subpart A and M (Revised Subpart B) - National Emission Standard for Hazardous Air Pollutants - Asbestos.
 - 2. Title 40 CFR 763 - Asbestos Hazard Emergency Response Act (AHERA) and Asbestos School Hazard Abatement Reauthorization Act (ASHARA).

1.4.4 STATE REQUIREMENTS:

- A. If State requirements are more stringent than Federal standards, the State requirements shall be followed.

1.4.5 LOCAL REQUIREMENTS:

If local requirements are more stringent than Federal or State standards, the local standards are to be followed.

1.4.6 PERMITS/LICENSES:

The Abatement Contractor shall apply for and have on-site all required permits and licenses to perform abatement work as required by Federal, State, and Local regulations.

1.4.7 POSTING AND FILING OF REGULATIONS:

Maintain one (1) copy of all applicable federal, state, and local regulations. The regulations will be kept in the Abatement Contractor's office for access. If required, the Contractor shall comply with all applicable State licensing requirements.

1.4.8 VA RESPONSIBILITIES:

Prior to commencement of work:

- A. Notify occupants adjacent to regulated areas of project dates and requirements for relocation, if needed. Arrangements must be made prior to starting work for relocation of desks, files, equipment, and personal possessions to avoid unauthorized access into the regulated area. Note: Notification of adjacent personnel is required by OSHA in

29 CFR 1926.1101 (k) to prevent unnecessary or unauthorized access to the regulated area.

- B. Submit to the Contractor results of background air sampling; including location of samples, person who collected the samples, equipment utilized, calibration data and method of analysis. During abatement, submit to the Contractor, results of bulk material analysis and air sampling data collected during the course of the abatement. This information shall not release the Contractor from any responsibility for OSHA compliance.

1.4.9 SITE SECURITY

- A. Regulated area access is to be restricted only to authorized, trained/accredited and protected personnel. These may include the Contractor's employees, employees of Subcontractors, VA employees and representatives, State and local inspectors, and any other designated individuals. A list of authorized personnel shall be established prior to commencing the project and be posted in the clean room of the decontamination unit.
- B. Entry into the regulated area by unauthorized individuals shall be reported immediately to the Competent Person by anyone observing the entry. The Competent Person shall immediately require any unauthorized person to leave the regulated area and then notify the VA Contracting Officer or VA Representative using the most expeditious means.
- C. A log book shall be maintained in the clean room of the decontamination unit. Anyone who enters the regulated area must record their name, affiliation, time in, and time out for each entry.
- D. Access to the regulated area shall be through a single decontamination unit. All other access (doors, windows, hallways, etc.) shall be sealed or locked to prevent entry to or exit from the regulated area. The only exceptions for this requirement are the waste/equipment load-out area which shall be sealed except during the removal of containerized asbestos waste from the regulated area, and emergency exits. Emergency exits shall not be locked from the inside; however, they shall be sealed with poly sheeting and taped until needed. In any situation where exposure to high temperatures which may result in a flame hazard, fire retardant poly sheeting must be used.
- E. The Contractor's Competent Person shall control site security during abatement operations in order to isolate work in progress and protect adjacent personnel. A 24 hour security system shall be provided at the entrance to the regulated area to assure that all entrants are logged in/out and that only authorized personnel are allowed entrance.
- F. The Contractor will have the VA's assistance in notifying adjacent personnel of the presence, location and quantity of ACM in the regulated area and enforcement of restricted access by the VA's employees.
- G. The regulated area shall be locked during non-working hours and secured by VA Representative or Competent Person. The VA Police should be informed of asbestos abatement regulated areas to provide security checks during facility rounds and emergency response.

1.4.10 EMERGENCY ACTION PLAN AND ARRANGEMENTS

- A. An Emergency Action Plan shall be developed by prior to commencing abatement activities and shall be agreed to by the Contractor and the VA. The Plan shall meet the requirements of 29 CFR 1910.38 (a); (b).

- B. Emergency procedures shall be in written form and prominently posted in the clean room and equipment room of the decontamination unit. Everyone, prior to entering the regulated area, must read and sign these procedures to acknowledge understanding of the regulated area layout, location of emergency exits and emergency procedures.
- C. Emergency planning shall include written notification of police, fire, and emergency medical personnel of planned abatement activities; work schedule; layout of regulated area; and access to the regulated area, particularly barriers that may affect response capabilities.
- D. Emergency planning shall include consideration of fire, explosion, hazardous atmospheres, electrical hazards, slips/trips and falls, confined spaces, and heat stress illness. Written procedures for response to emergency situations shall be developed and employee training in procedures shall be provided.
- E. Employees shall be trained in regulated area/site evacuation procedures in the event of workplace emergencies.
 - 1. For non life-threatening situations - employees injured or otherwise incapacitated shall decontaminate following normal procedures with assistance from fellow workers, if necessary, before exiting the regulated area to obtain proper medical treatment.
 - 2. For life-threatening injury or illness, worker decontamination shall take least priority after measures to stabilize the injured worker, remove them from the regulated area, and secure proper medical treatment.
- F. Telephone numbers of any/all emergency response personnel shall be prominently posted in the clean room, along with the location of the nearest telephone.
- G. The Contractor shall provide verification of first aid/CPR training for personnel responsible for providing first aid/CPR. OSHA requires medical assistance within 3-4 minutes of a life-threatening injury/illness. Bloodborne Pathogen training shall also be verified for those personnel required to provide first aid/CPR.
- H. The Emergency Action Plan shall provide for a Contingency Plan in the event that an incident occurs that may require the modification of the standard operating procedures during abatement. Such incidents include, but are not limited to, fire; accident; power failure; negative pressure failure; and supplied air system failure. The Contractor shall detail procedures to be followed in the event of an incident assuring that asbestos abatement work is stopped and wetting is continued until correction of the problem.

1.4.11 ACCIDENT PREVENTION

- A. The Abatement Contractor shall provide and maintain a work environment and procedures which will safeguard the public and VA staff personnel, property, materials, supplies, and equipment which may be adjacent to the Abatement Contractor's regulated areas. The Abatement Contractor will avoid interruptions of VA operations so the project will be completed on schedule.
- B. While performing abatement activities, the Abatement Contractor shall provide all/any required safety barricades, signs, and signal lights. The Abatement Contractor shall comply with all applicable standards related to abatement operations as mandated by OSHA/EPA/State Standards. The Abatement Contractor shall provide a copy of and comply

with the pertinent provisions of the latest version of the U.S. Army Corps of Engineers Safety and Health Requirements Manual, EM 385-1-1.

- C. Whenever the Contracting Officer (CO) becomes aware of any noncompliance with these requirements or any condition which poses a serious or imminent danger to the health or safety of the public or VA patients/personnel, the CO shall notify the Abatement Contractor's Competent Person orally, with written confirmation and request immediate corrective action(s) be taken to abate the noncompliant condition. This notice, when delivered to the Abatement Contractor or the Contractor's representative, shall be deemed sufficient notice of noncompliance and that corrective action is required. The Abatement Contractor shall take corrective action immediately upon receipt of the oral/written notice.
- If the Abatement Contractor fails or refuse to promptly take corrective action, the CO has the option to issue an order to stop all or part of the work until correction actions have been taken. The Abatement Contractor shall have no entitlement to any equitable adjustment of the contract price or extension of the performance schedule based on any stop work order issued under this clause.
- D. The Abatement Contractor shall include the provisions of 1.4.11 in any subcontractor agreement.
- E. The Abatement Contractor shall submit a written plan for implementing 1.4.11. The plan shall include an analysis of any significant hazards to life, limb, and property inherent to abatement work and a plan for controlling these hazards.
- F. The Resident Engineer or other designated VA employee, if designated by the CO, shall serve as the Safety Officer and has authority to enforce the Accident Prevention requirements.

1.4.12 PRE-CONSTRUCTION MEETING

Prior to commencing the work, the Contractor shall meet with the VA Certified Industrial Hygienist (VPCIH) to present and review, as appropriate, the items following this paragraph. The Contractor's Competent Person(s) who will be on-site shall participate in the pre-start meeting. The pre-start meeting is to discuss and determine procedures to be used during the project. At this meeting, the Contractor shall provide:

- A. Proof of Contractor licensing.
- B. Proof the Competent Person(s) is trained and accredited and approved for working in this State. Verification of the experience of the Competent Person(s) shall also be presented.
- C. A list of all workers who will participate in the project, including experience and verification of training and accreditation.
- D. A list of and verification of training for all personnel who have current first-aid/CPR training. A minimum of one person per shift must have adequate training.
- E. Current medical written opinions for all personnel working on-site meeting the requirements of 29 CFR 1926.1101 (m).
- F. Current fit-tests for all personnel wearing respirators on-site meeting the requirements of 29 CFR 1926.1101 (h) and Appendix C.
- G. A copy of the Contractor's Asbestos Hazard Abatement Plan. In these procedures, the following information must be detailed, specific for this project.

1. Regulated area preparation procedures;
 2. Notification requirements procedure of Contractor as required in 29 CFR 1926.1101 (d);
 3. Decontamination area set-up/layout and decontamination procedures for employees;
 4. Abatement methods/procedures and equipment to be used; and
 5. Personal protective equipment to be used.
- H. At this meeting the Contractor shall provide all submittals as required.
- I. Procedures for handling, packaging and disposal of asbestos waste.
- J. Emergency Action Plan and Contingency Plan Procedures.

1.5 ABATEMENT PROJECT COORDINATION

Following are the minimum personnel necessary for coordination of the abatement work.

1.5.1 PERSONNEL

- A. Administrative and supervisory personnel shall consist of a qualified Competent Person(s) as defined by OSHA in the Construction Standards and the Asbestos Construction Standard; Contractor Professional Industrial Hygienist and Industrial Hygiene Technicians. These employees are the Contractor's representatives responsible for compliance with these specifications and all other applicable requirements.
- B. Non-supervisory personnel shall consist of an adequate number of qualified personnel to meet the schedule requirements of the project. Personnel shall meet required qualifications. Personnel utilized on-site shall be pre-approved by the VA representative. A request for approval shall be submitted for any person to be employed during the project giving the person's name; social security number; qualifications; accreditation card with color picture; Certificate of Worker's Acknowledgment; and Affidavit of Medical Surveillance and Respiratory Protection and current Respirator Fit Test.
- C. Minimum qualifications for Contractor and assigned personnel are:
1. The Contractor has conducted within the last three (3) years, three (3) projects of similar complexity and dollar value as this project; has not been cited and penalized for serious violations of federal (and state as applicable) EPA and OSHA asbestos regulations in the past three (3) years; has adequate liability/occurrence insurance for asbestos work as required by the state; is licensed in applicable states; has adequate and qualified personnel available to complete the work; has comprehensive standard operating procedures for asbestos work; has adequate materials, equipment and supplies to perform the work.
 2. The Competent Person has four (4) years of abatement experience of which two (2) years were as the Competent Person on the project; meets the OSHA definition of a Competent Person; has been the Competent Person on two (2) projects of similar size and complexity as this project within the past three (3) years; has completed EPA AHERA/OSHA/State/Local training requirements/accreditation(s) and refreshers; and has all required OSHA documentation related to medical and respiratory protection.
 3. The Contractor Professional Industrial Hygienist/CIH (CPIH/CIH) shall have five (5) years of monitoring experience and supervision

of asbestos abatement projects; has participated as senior IH on five (5) abatement projects, three (3) of which are similar in size and complexity as this project; has developed at least one complete standard operating procedure for asbestos abatement; has trained abatement personnel for three (3) years; has specialized EPA AHERA/OSHA training in asbestos abatement management, respiratory protection, waste disposal and asbestos inspection; has completed the NIOSH 582 Course or equivalent, Contractor/Supervisor course; and has appropriate medical/respiratory protection records/documentation.

4. The Abatement Personnel shall have completed the EPA AHERA/OSHA abatement worker course; have training on the standard operating procedures of the Contractor; has one year of asbestos abatement experience within the past three (3) years of similar size and complexity; has applicable medical and respiratory protection documentation; has certificate of training/current refresher and State accreditation/license.

All personnel should be in compliance with OSHA construction safety training as applicable and submit certification.

1.6 WORKER PROTECTION

1.6.1 TRAINING OF ABATEMENT PERSONNEL

Prior to beginning any abatement activity, all personnel shall be trained in accordance with OSHA 29 CFR 1926.1101 (k)(9) and any additional State/Local requirements. Training must include, at a minimum, the elements listed at 29 CFR 1926.1101 (k)(9)(viii). Training shall have been conducted by a third party, EPA/State approved trainer meeting the requirements of EPA 40 CFR 763 Appendix C (AHERA MAP). Initial training certificates and current refresher and accreditation proof must be submitted for each person working at the site. The OSHA Construction Safety 10 Hour course shall be required for all on-site contractors' personnel.

1.6.2 PERSONAL PROTECTIVE EQUIPMENT

Provide, at a minimum, steel toe boots, hard hats, safety glasses, protective clothing, respiratory protection and any other personal protective equipment as determined by conducting the hazard assessment required by OSHA at 29 CFR 1910.132 (d). A copy of the hazard assessment shall be provided to the VPIH. The Competent Person and CPIH shall ensure the provision of and the integrity of personal protective equipment worn for the duration of the project.

1.7 RESPIRATORY PROTECTION

1.7.1 GENERAL - RESPIRATORY PROTECTION PROGRAM

The Contractor shall develop and implement a written Respiratory Protection Program (RPP) which is in compliance with the January 8, 1998 OSHA requirements found at 29 CFR 1926.1101 and 29 CFR 1910.Subpart I;134. ANSI Standard Z88.2-1992 provides excellent guidance for developing a respiratory protection program. All respirators used must be NIOSH approved for asbestos abatement activities. The written RPP shall, at a minimum, contain the basic

requirements found at 29 CFR 1910.134 (c)(1)(i - ix) - Respiratory Protection Program.

1.7.2 RESPIRATORY PROTECTION PROGRAM COORDINATOR

The Respiratory Protection Program Coordinator (RPPC) must be identified and shall have two (2) years experience coordinating RPP of similar size and complexity. The RPPC must submit a signed statement attesting to the fact that the program meets the above requirements.

1.7.3 SELECTION AND USE OF RESPIRATORS

The procedure for the selection and use of respirators must be submitted to the VA as part of the Contractor's qualifications. The procedure must be written clearly enough for workers to understand. A copy of the Respiratory Protection Program must be available in the clean room of the decontamination unit for reference by employees or authorized visitors.

1.7.4 MINIMUM RESPIRATORY PROTECTION

Minimum respiratory protection shall be a full face powered air purifying respirator when fiber levels are maintained consistently at or below 0.5 f/cc. A higher level of respiratory protection may be provided or required, depending on fiber levels. Respirator selection shall meet the requirements of 29 CFR 1926.1101 (h); Table 1, except as indicated in this paragraph. Abatement personnel must have a respirator for their exclusive use.

1.7.5 MEDICAL WRITTEN OPINION

No employee shall be allowed to wear a respirator unless a physician or other licensed health care professional has provided a written determination they are medically qualified to wear the class of respirator to be used on the project while wearing whole body impermeable garments and subjected to heat or cold stress.

1.7.6 RESPIRATOR FIT TEST

All personnel wearing respirators shall have a current qualitative/quantitative fit test which was conducted in accordance with 29 CFR 1910.134 (f) and Appendix A. Quantitative fit tests shall be done for PAPR's which have been put into a motor/blower failure mode

1.7.7 RESPIRATOR FIT CHECK

The Competent Person shall assure that the positive/negative pressure user seal check is done each time the respirator is donned by an employee. Head coverings must cover respirator head straps. Any situation that prevents an effective facepiece to face seal as evidenced by failure of a user seal check shall preclude that person from wearing a respirator inside the regulated area until resolution of the problem.

1.7.8 MAINTENANCE AND CARE OF RESPIRATORS:

The Respiratory Protection Program Coordinator shall submit evidence and documentation showing compliance with 29 CFR 1910.134 (h) Maintenance and care of respirators.

1.7.9 SUPPLIED AIR SYSTEMS

If a supplied air system is used, the system shall meet all requirements of 29 CFR 1910.134 and the ANSI/Compressed Gas Association (CGA) Commodity Specification for Air current requirements for Type 1 - Grade D breathing air. Low pressure systems are not allowed to be used on asbestos abatement projects. Supplied Air respirator use shall be in accordance with EPA/NIOSH publication EPA-560-OPTS-86-001 "A Guide to Respiratory Protection for the Asbestos Abatement Industry". The competent person on site will be responsible for the supplied air system to ensure the safety of the worker.

1.8 WORKER PROTECTION

1.8.1 MEDICAL EXAMINATIONS

Medical examinations meeting the requirements of 29 CFR 1926.1101 (m) shall be provided for all personnel working in the regulated area, regardless of exposure levels. A current physician's written opinion as required by 29 CFR 1926.1101 (m)(4) shall be provided for each person and shall include in the medical opinion the person has been evaluated for working in a heat and cold stress environment while wearing personal protective equipment (PPE) and is able to perform the work without risk of material health impairment.

1.8.2 PROTECTIVE CLOTHING

Provide boots, booties, hard hats, goggles, clothing, respirators and any other personal protective equipment as determined by conducting the hazard assessment required by OSHA at 29 CFR 1910.132 (d). Provide all personnel entering the regulated area with disposable full body coveralls, disposable head covering, and 18 inch boot coverings. The Competent Person shall ensure the integrity of personal protective equipment worn for the duration of the project. Provide plastic/rubber disposable gloves for hand protection. Cloth type gloves may be worn under plastic/rubber gloves, but cannot be used alone. Duct tape shall be used to secure all suit sleeves to wrists and to secure foot coverings at the ankle. Worker protection shall meet the most stringent requirement.

1.8.3 REGULATED AREA ENTRY PROCEDURE

The Competent Person shall ensure that each time workers enter the regulated area; they remove ALL street clothes in the clean room of the decontamination unit and put on new disposable coveralls, head coverings, a clean respirator, and then proceed through the shower room to the equipment room where they put on non-disposable required personal protective equipment.

1.8.4 DECONTAMINATION PROCEDURE

The Competent Person shall require all personnel to adhere to following decontamination procedures whenever they leave the regulated area.

- A. When exiting the regulated area, remove disposable coveralls, and ALL other clothes, disposable head coverings, and foot coverings or boots in the equipment room.
- B. Still wearing the respirator and completely naked, proceed to the shower. Showering is MANDATORY. Care must be taken to follow reasonable procedures in removing the respirator to avoid inhaling asbestos fibers while showering. The following procedure is required as a minimum:
 1. Thoroughly wet body including hair and face. If using a PAPR hold blower above head to keep filters dry.
 2. With respirator still in place, thoroughly decontaminate body, hair, respirator face piece, and all other parts of the respirator except the blower and battery pack on a PAPR. Pay particular attention to cleaning the seal between the face and respirator facepiece and under the respirator straps.
 3. Take a deep breath, hold it and/or exhale slowly, completely wetting hair, face, and respirator. While still holding breath, remove the respirator and hold it away from the face before starting to breathe.
- C. Carefully decontaminate the facepiece of the respirator inside and out. If using a PAPR, shut down using the following sequence: a) first cap inlets to filters; b) turn blower off to keep debris collected on the inlet side of the filter from dislodging and contaminating the outside of the unit; c) thoroughly decontaminate blower and hoses; d) carefully decontaminate battery pack with a wet rag being cautious of getting water in the battery pack thus preventing destruction. (THIS PROCEDURE IS NOT A SUBSTITUTE FOR RESPIRATOR CLEANING!).
- D. Shower and wash body completely with soap and water. Rinse thoroughly.
- E. Rinse shower room walls and floor to drain prior to exiting.
- F. Proceed from shower to clean room; dry off and change into street clothes or into new disposable work clothing.

1.8.5 REGULATED AREA REQUIREMENTS

The Competent Person shall meet all requirements of 29 CFR 1926.1101 (o) and assure that all requirements for regulated areas at 29 CFR 1926.1101 (e) are met. All personnel in the regulated area shall not be allowed to eat, drink, smoke, chew tobacco or gum, apply cosmetics, or in any way interfere with the fit of their respirator.

1.9 DECONTAMINATION FACILITIES

1.9.1 DESCRIPTION

Provide each regulated area with separate personnel (PDF) and equipment/waste decontamination facilities (EWDF). Ensure that the PDF are the only means of ingress and egress to the regulated area and that all equipment, bagged waste, and other material exit the regulated area only through the EWDF. Separate shower facilities must be provided for males/females as per OSHA requirements. See drawings for minimum requirements of each and OSHA 29 CFR 1926.1101, Appendix F.

1.9.2 GENERAL REQUIREMENTS

All personnel entering or exiting a regulated area must go through the PDF and shall follow the requirements at 29 CFR 1926.1101 (j)(1) and these specifications. All waste, equipment and contaminated materials must exit the regulated area through the W/EDF and be decontaminated in accordance with these specifications. Walls and ceilings of the PDF and W/EDF must be constructed of a minimum of 3 layers of 6 mil opaque fire retardant polyethylene sheeting and be securely attached to existing building components and/or an adequate temporary framework. A minimum of 3 layers of 6 mil poly shall also be used to cover the floor under the PDF and W/EDF units. Construct doors so that they overlap and secure to adjacent surfaces. Weight inner doorway sheets with layers of duct tape so that they close quickly after release. Put arrows on sheets so they show direction of travel and overlap. If the building adjacent area is occupied, construct a solid barrier on the occupied side(s) to protect the sheeting and reduce potential for non-authorized personnel entering the regulated area.

1.9.3 TEMPORARY FACILITIES TO THE PDF AND EWDF

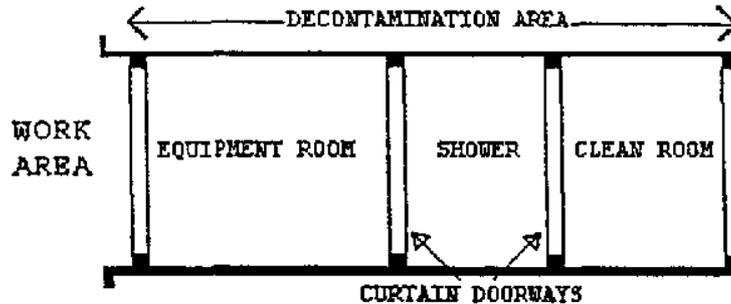
The Competent Person shall provide temporary water service connections to the PDF and W/EDF. Backflow prevention must be provided at the point of connection to the VA system. Water supply must be of adequate pressure and meet requirements of 29 CFR 1910.141(d)(3). Provide adequate temporary overhead electric power with ground fault circuit interruption (GFCI) protection. Provide a sub-panel equipped with GFCI protection for all temporary power in the clean room. Provide adequate lighting to provide a minimum of 50 foot candles in the PDF and W/EDF. Provide temporary heat, if needed, to maintain 70°F throughout the PDF and W/EDF.

1.9.3 PERSONNEL DECONTAMINATION FACILITY (PDF)

The Competent Person shall provide a PDF consisting of shower room which is contiguous to a clean room and equipment room which is connected to the regulated area. The PDF must be sized to accommodate the number of personnel scheduled for the project. The shower room, located in the center of the PDF, shall be fitted with as many portable showers as necessary to insure all employees can complete the entire decontamination procedure within 15 minutes. The PDF shall be constructed of opaque poly for privacy. The PDF shall be constructed to eliminate any parallel routes of egress without showering.

1. Clean Room: The clean room must be physically and visually separated from the rest of the building to protect the privacy of personnel changing clothes. The clean room shall be constructed of at least 3 layers of 6 mil opaque fire retardant poly to provide an air tight room. Provide a minimum of 2 - 900 mm (3 foot) wide 6 mil poly opaque fire retardant doorways. One doorway shall be the entry from outside the PDF and the second doorway shall be to the shower room of the PDF. The floor of the clean room shall be maintained in a clean, dry condition. Shower overflow shall not be allowed into the clean room. Provide 1 storage locker per person. A portable fire extinguisher, minimum 10 pounds capacity, Type ABC, shall be provided in accordance with OSHA and NFPA Standard 10. All persons entering the regulated area shall remove all street clothing in the clean room and dress in disposable protective clothing and respiratory protection. Any person entering the clean room does so

- either from the outside with street clothing on or is coming from the shower room completely naked and thoroughly washed. Females required to enter the regulated area shall be ensured of their privacy throughout the entry/exit process by posting guards at both entry points to the PDF so no male can enter or exit the PDF during her stay in the PDF.
2. Shower Room: The Competent Person shall assure that the shower room is a completely water tight compartment to be used for the movement of all personnel from the clean room to the equipment room and for the showering of all personnel going from the equipment room to the clean room. Each shower shall be constructed so water runs down the walls of the shower and into a drip pan. Install a freely draining smooth floor on top of the shower pan. The shower room shall be separated from the rest of the building and from the clean room and equipment room using air tight walls made from at least 3 layers of 6 mil opaque fire retardant poly. The shower shall be equipped with a shower head and controls, hot and cold water, drainage, soap dish and continuous supply of soap, and shall be maintained in a sanitary condition throughout its use. The controls shall be arranged so an individual can shower without assistance. Provide a flexible hose shower head, hose bibs and all other items shown on Shower Schematic. Waste water will be pumped to a drain after being filtered through a minimum of a 100 micron sock in the shower drain; a 20 micron filter; and a final 5 micron filter. Filters will be changed a minimum of daily or more often as needed. Filter changes must be done in the shower to prevent loss of contaminated water. Hose down all shower surfaces after each shift and clean any debris from the shower pan. Residue is to be disposed of as asbestos waste.
 3. Equipment Room: The Competent Person shall provide an equipment room which shall be an air tight compartment for the storage of work equipment/tools, reusable personal protective equipment, except for a respirator and for use as a gross decontamination area for personnel exiting the regulated area. The equipment room shall be separated from the regulated area by a minimum 3 foot wide door made with 2 layers of 6 mil opaque fire retardant poly. The equipment room shall be separated from the regulated area, the shower room and the rest of the building by air tight walls and ceiling constructed of a minimum of 3 layers of 6 mil opaque fire retardant poly. Damp wipe all surfaces of the equipment room after each shift change. Provide an additional loose layer of 6 mil fire retardant poly per shift change and remove this layer after each shift. If needed, provide a temporary electrical sub-panel equipped with GFCI in the equipment room to accommodate any equipment required in the regulated area.
 4. The PDF shall be as follows: Clean room at the entrance followed by a shower room followed by an equipment room leading to the regulated area. Each doorway in the PDF shall be a minimum of 2 layers of 6 mil opaque fire retardant poly.

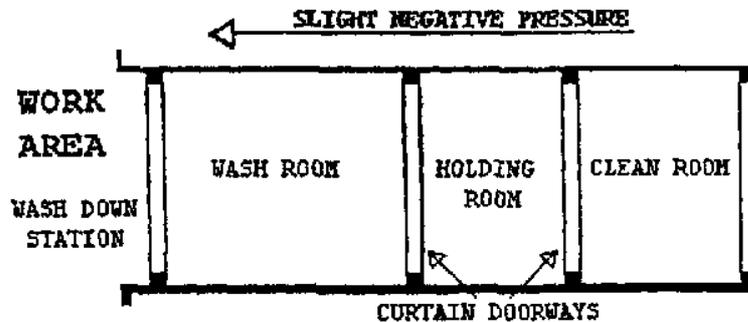


1.9.5 EQUIPMENT/WASTE DECONTAMINATION FACILITY (EWDF)

The Competent Person shall provide a W/EDF consisting of a wash room, holding room, and clean room for removal of waste, equipment and contaminated material from the regulated area. Personnel shall not enter or exit the W/EDF except in the event of an emergency. Clean debris and residue in the W/EDF daily. All surfaces in the W/EDF shall be wiped/hosed down after each shift and all debris shall be cleaned from the shower pan. The W/EDF shall consist of the following:

1. Wash Down Station: Provide an enclosed shower unit in the regulated area just outside the Wash Room as an equipment bag and container cleaning station.
2. Wash Room: Provide a wash room for cleaning of bagged or containerized asbestos containing waste materials passed from the regulated area. Construct the wash room using 50 x 100 mm (2" x 4") wood framing and 3 layers of 6 mil fire retardant poly. Locate the wash room so that packaged materials, after being wiped clean, can be passed to the Holding Room. Doorways in the wash room shall be constructed of 2 layers of 6 mil fire retardant poly.
3. Holding Room: Provide a holding room as a drop location for bagged materials passed from the wash room. Construct the holding room using 50 x 100 mm (2" x 4") wood framing and 3 layers of 6 mil fire retardant poly. The holding room shall be located so that bagged material cannot be passed from the wash room to the clean room unless it goes through the holding room. Doorways in the holding room shall be constructed of 2 layers of 6 mil fire retardant poly.
4. Clean Room: Provide a clean room to isolate the holding room from the exterior of the regulated area. Construct the clean room using 2 x 4 wood framing and 2 layers of 6 mil fire retardant poly. The clean room shall be located so as to provide access to the holding room from the building exterior. Doorways to the clean room shall be constructed of 2 layers of 6 mil fire retardant poly. When a negative pressure differential system is used, a rigid enclosure separation between the W/EDF clean room and the adjacent areas shall be provided.

5. The W/EDF shall be as follows: Wash Room leading to a Holding Room followed by a Clean Room leading to outside the regulated area. See diagram.



1.9.6 EQUIPMENT/WASTE DECONTAMINATION PROCEDURES:

At the wash down station in the regulated area, thoroughly wet clean contaminated equipment and/or sealed polyethylene bags and pass into Wash Room after visual inspection. When passing anything into the Wash Room, close all doorways of the W/EDF, other than the doorway between the wash down station and the Wash Room. Keep all outside personnel clear of the W/EDF. Once inside the Wash Room, wet clean the equipment and/or bags. After cleaning and inspection, pass items into the Holding Room. Close all doorways except the doorway between the Holding Room and the Clean Room. Workers from the Clean Room/Exterior shall enter the Holding Room and remove the decontaminated/cleaned equipment/bags for removal and disposal. These personnel will not be required to wear PPE. At no time shall personnel from the clean side be allowed to enter the Wash Room.

PART 2 - PRODUCTS, MATERIALS AND EQUIPMENT

2.1 MATERIALS AND EQUIPMENT

2.21.1 GENERAL REQUIREMENTS (ALL ABATEMENT PROJECTS)

Prior to the start of work, the contractor shall provide and maintain a sufficient quantity of materials and equipment to assure continuous and efficient work throughout the duration of the project. Work shall not start unless the following items have been delivered to the site and the CPIH/CIH has submitted verification to the VA's representative.

- A. All materials shall be delivered in their original package, container or bundle bearing the name of the manufacturer and the brand name (where applicable).
- B. Store all materials subject to damage off the ground, away from wet or damp surfaces and under cover sufficient enough to prevent damage or contamination. Flammable and combustible materials cannot be stored inside buildings. Replacement materials shall be stored outside of the regulated area until abatement is completed.

- C. The Contractor shall not block or hinder use of buildings by patients, staff, and visitors to the VA in partially occupied buildings by placing materials/equipment in any unauthorized location.
- D. The Competent Person shall inspect for damaged, deteriorating or previously used materials. Such materials shall not be used and shall be removed from the worksite and disposed of properly.
- E. Polyethylene sheeting for walls in the regulated area shall be a minimum of 4-mil, unless otherwise specified by the VA or more stringent State requirement(s). For floors and all other uses, sheeting of at least 6-mil shall be used in widths selected to minimize the frequency of joints. Fire retardant poly shall be used throughout.
- F. The method of attaching polyethylene sheeting shall be agreed upon in advance by the Contractor and the VA and selected to minimize damage to equipment and surfaces. Method of attachment may include any combination of moisture resistant duct tape furring strips, spray glue, staples, nails, screws, lumber and plywood for enclosures or other effective procedures capable of sealing polyethylene to dissimilar finished or unfinished surfaces under both wet and dry conditions.
- G. Polyethylene sheeting utilized for the PDF shall be opaque white or black in color, 6 mil fire retardant poly.
- H. Installation and plumbing hardware, showers, hoses, drain pans, sump pumps and waste water filtration system shall be provided by the Contractor.
- I. An adequate number of HEPA vacuums, scrapers, sprayers, nylon brushes, brooms, disposable mops, rags, sponges, staple guns, shovels, ladders and scaffolding of suitable height and length as well as meeting OSHA requirements, fall protection devices, water hose to reach all areas in the regulated area, airless spray equipment, and any other tools, materials or equipment required to conduct the abatement project. All electrically operated hand tools, equipment, electric cords shall be connected to GFCI protection.
- J. Special protection for objects in the regulated area shall be detailed (e.g., plywood over carpeting or hardwood floors to prevent damage from scaffolds, water and falling material).
- K. Disposal bags - 2 layers of 6 mil poly for asbestos waste shall be pre-printed with labels, markings and address as required by OSHA, EPA and DOT regulations.
- L. The VA shall be provided an advance copy of the MSDS as required for all hazardous chemicals under OSHA 29 CFR 1910.1200 - Hazard Communication in the pre-project submittal. Chlorinated compounds shall not be used with any spray adhesive, mastic remover or other product. Appropriate encapsulant(s) shall be provided.
- M. OSHA DANGER demarcation signs, as many and as required by OSHA 29 CFR 1926.1101(k)(7) shall be provided and placed by the Competent Person. All other posters and notices required by Federal and State regulations shall be posted in the Clean Room.
- N. Adequate and appropriate PPE for the project and number of personnel/shifts shall be provided. All personal protective equipment issued must be based on a written hazard assessment conducted under 29 CFR 1910.132(d).

2.1.2 NEGATIVE PRESSURE FILTRATION SYSTEM

The Contractor shall provide enough HEPA negative air machines to continuously maintain a pressure differential of -0.02" water column

gauge. The Competent Person shall determine the number of units needed for the regulated area by dividing the cubic feet in the regulated area by 15 and then dividing that result by the cubic feet per minute (CFM) for each unit to determine the number of units needed to continuously maintain a pressure differential of -0.02" WCG. Provide a standby unit in the event of machine failure and/or emergency in an adjacent area.

NIOSH has done extensive studies and has determined that negative air machines typically operate at ~50% efficiency. The contractor shall consider this in their determination of number of units needed to continuously maintain a pressure differential of -0.02" water column gauge. The contractor shall use 8 air changes per hour or double the number of machines, based on their calculations, or submit proof their machines operate at stated capacities, at a 2" pressure drop across the filters.

2.1.3 DESIGN AND LAYOUT

- A. Before start of work submit the design and layout of the regulated area and the negative air machines. The submittal shall indicate the number of, location of and size of negative air machines. The point(s) of exhaust, air flow within the regulated area, anticipated negative pressure differential, and supporting calculations for sizing shall be provided. In addition, submit the following:
 - 1. Method of supplying power to the units and designation/location of the panels.
 - 2. Description of testing method(s) for correct air volume and pressure differential.
 - 3. If auxiliary power supply is to be provided for the negative air machines, provide a schematic diagram of the power supply and manufacturer's data on the generator and switch.

2.1.4 NEGATIVE AIR MACHINES (HEPA UNITS)

- A. Negative Air Machine Cabinet: The cabinet shall be constructed of steel or other durable material capable of withstanding potential damage from rough handling and transportation. The width of the cabinet shall be less than 30" in order to fit in standard doorways. The cabinet must be factory sealed to prevent asbestos fibers from being released during use, transport, or maintenance. Any access to and replacement of filters shall be from the inlet end. The unit must be on casters or wheels.
- B. Negative Air Machine Fan: The rating capacity of the fan must indicate the CFM under actual operating conditions. Manufacturer's typically use "free-air" (no resistance) conditions when rating fans. The fan must be a centrifugal type fan.
- C. Negative Air Machine Final Filter: The final filter shall be a HEPA filter. The filter media must be completely sealed on all edges within a structurally rigid frame. The filter shall align with a continuous flexible gasket material in the negative air machine housing to form an air tight seal. Each HEPA filter shall be certified by the manufacturer to have an efficiency of not less than 99.97%. Testing shall have been done in accordance with Military Standard MIL-STD-282 and Army Instruction Manual 136-300-175A. Each filter must bear a UL586 label to indicate ability to perform under specified conditions. Each filter shall be marked with the name of the manufacturer, serial number, air

flow rating, efficiency and resistance, and the direction of test air flow.

- D. Negative Air Machine Pre-filters: The pre-filters, which protect the final HEPA filter by removing larger particles, are required to prolong the operating life of the HEPA filter. Two stages of pre-filtration are required. A first stage pre-filter shall be a low efficiency type for particles 10 μ m or larger. A second stage pre-filter shall have a medium efficiency effective for particles down to 5 μ m or larger. Pre-filters shall be installed either on or in the intake opening of the negative air machine and the second stage filter must be held in place with a special housing or clamps.
- E. Negative Air Machine Instrumentation: Each unit must be equipped with a gauge to measure the pressure drop across the filters and to indicate when filters have become loaded and need to be changed. A table indicating the cfm for various pressure readings on the gauge shall be affixed near the gauge for reference or the reading shall indicate at what point the filters shall be changed, noting cfm delivery. The unit must have an elapsed time meter to show total hours of operation.
- F. Negative Air Machine Safety and Warning Devices: An electrical/mechanical lockout must be provided to prevent the fan from being operated without a HEPA filter. Units must be equipped with an automatic shutdown device to stop the fan in the event of a rupture in the HEPA filter or blockage in the discharge of the fan. Warning lights are required to indicate normal operation; too high a pressure drop across filters; or too low of a pressure drop across filters.
- G. Negative Air Machine Electrical: All electrical components shall be approved by the National Electrical Manufacturer's Association (NEMA) and Underwriters Laboratories (UL). Each unit must be provided with overload protection and the motor, fan, fan housing, and cabinet must be grounded.
- H. It is essential that replacement HEPA filters be tested using an "in-line" testing method, to ensure the seal around the periphery was not damaged during replacement. Damage to the outer HEPA filter seal could allow contaminated air to bypass the HEPA filter and be discharged to an inappropriate location. Contractor will provide written documentation of test results for negative air machine units with HEPA filters changed by the contractor or documentation when changed and tested by the contractor filters.

2.1.5 PRESSURE DIFFERENTIAL

The fully operational negative air system within the regulated area shall continuously maintain a pressure differential of -0.02" water column gauge. Before any disturbance of any asbestos material, this shall be demonstrated to the VA by use of a pressure differential meter/manometer as required by OSHA 29 CFR 1926.1101(e)(5)(i). The Competent Person shall be responsible for providing, maintaining, and documenting the negative pressure and air changes as required by OSHA and this specification.

2.1.6 MONITORING

The pressure differential shall be continuously monitored and recorded between the regulated area and the area outside the regulated area with a monitoring device that incorporates a strip chart recorder. The strip

chart recorder shall become part of the project log and shall indicate

at least -0.02" water column gauge for the duration of the project.

2.1.7 AUXILIARY GENERATOR

If the building is occupied during abatement, provide an auxiliary gasoline/diesel generator located outside the building in an area protected from the weather. In the event of a power failure of the general power grid and the VAMC emergency power grid, the generator must automatically start and supply power to a minimum of 50% of the negative air machines in operation

2.1.8 SUPPLEMENTAL MAKE-UP AIR INLETS

Provide, as needed for proper air flow in the regulated area, in a location approved by the VA, openings in the plastic sheeting to allow outside air to flow into the regulated area. Auxiliary makeup air inlets must be located as far from the negative air machines as possible, off the floor near the ceiling, and away from the barriers that separate the regulated area from the occupied clean areas. Cover the inlets with weighted flaps which will seal in the event of failure of the negative pressure system.

2.1.9 TESTING THE SYSTEM

The negative pressure system must be tested before any ACM is disturbed in any way. After the regulated area has been completely prepared, the decontamination units set up, and the negative air machines installed, start the units up one at a time. Demonstrate and document the operation and testing of the negative pressure system to the VA using smoke tubes and a negative pressure gauge. Verification and documentation of adequate negative pressure differential across each barrier must be done at the start of each work shift.

2.1.10 DEMONSTRATION OF THE NEGATIVE AIR PRESSURE SYSTEM

The demonstration of the operation of the negative pressure system to the VA shall include, but not be limited to, the following:

- A. Plastic barriers and sheeting move lightly in toward the regulated area.
- B. Curtains of the decontamination units move in toward regulated area.
- C. There is a noticeable movement of air through the decontamination units. Use the smoke tube to demonstrate air movement from the clean room to the shower room to the equipment room to the regulated area.
- D. Use smoke tubes to demonstrate air is moving across all areas in which work is to be done. Use a differential pressure gauge to indicate a negative pressure of at least -0.02" across every barrier separating the regulated area from the rest of the building. Modify the system as necessary to meet the above requirements.

2.1.11 USE OF SYSTEM DURING ABATEMENT OPERATIONS

- A. Start units before beginning any disturbance of ACM occurs. After work begins, the units shall run continuously, maintaining 4 actual air changes per hour at a negative pressure differential of -0.02" water column gauge, for the duration of the work until a final visual clearance and final air clearance has been successfully completed.

No negative air units shall be shut down at any time unless authorized by the VA Contracting Officer, verbally and in writing.

- B. Abatement work shall begin at a location farthest from the units and proceed towards them. If an electric failure occurs, the Competent Person shall stop all abatement work and immediately begin wetting all exposed asbestos materials for the duration of the power outage. Abatement work shall not resume until power is restored and all units are operating properly again.
- C. The negative air machines shall continue to run after all work is completed and until a final visual clearance and a final air clearance has been successfully completed for that regulated area.

2.1.12 DISMANTLING THE SYSTEM

After completion of the final visual and final air clearance has been obtained by the VPIH/CIH, the units may be shut down. The unit exterior surfaces shall have been completely decontaminated; pre-filters are not to be removed and the units inlet/outlet sealed with 2 layers of 6 mil poly immediately after shut down. No filter removal shall occur at the VA site following successful completion of site clearance. OSHA/EPA/DOT asbestos shall be attached to the units.

2.2 CONTAINMENT BARRIERS AND COVERINGS IN THE REGULATED

AREA 2.2.1 GENERAL

Seal off the perimeter to the regulated area to completely isolate the regulated area from adjacent spaces. All surfaces in the regulated area must be covered to prevent contamination and to facilitate clean-up. Should adjacent areas become contaminated as a result of the work, shall immediately stop work and clean up the contamination at no additional cost to the VA. Provide firestopping and identify all fire barrier penetrations due to abatement work as specified in Section 2.2.8; FIRESTOPPING.

2.2.2 PREPARATION PRIOR TO SEALING THE REGULATED AREA

Place all tools, scaffolding, materials and equipment needed for working in the regulated area prior to erecting any plastic sheeting. All uncontaminated removable furniture, equipment and/or supplies shall be removed by the VA from the regulated area before commencing work. Any objects remaining in the regulated area shall be completely covered with 2 layers of 6-mil fire retardant poly sheeting and secured with duct tape. Lock out and tag out any HVAC/electrical systems in the regulated area

2.2.3 CONTROLLING ACCESS TO THE REGULATED AREA

Access to the regulated area is allowed only through the personnel decontamination facility (PDF). All other means of access shall be eliminated and OSHA DANGER demarcation signs posted as required by OSHA. If the regulated area is adjacent to, or within view of an occupied area, provide a visual barrier of 6 mil opaque fire retardant poly to prevent building occupant observation. If the adjacent area is accessible to the public, the barrier must be solid and capable of withstanding the negative pressure.

2.2.4 CRITICAL BARRIERS

Completely separate any operations in the regulated area from adjacent areas using 2 layers of 6 mil fire retardant poly and duct tape. Individually seal with 2 layers of 6 mil poly and duct tape all HVAC openings into the regulated area. Individually seal all lighting fixtures, clocks, doors, windows, convectors, speakers, or any other objects/openings in the regulated area. Heat must be shut off any objects covered with poly.

2.2.5 PRIMARY BARRIERS

- A. Cover the regulated area with two layers of 6 mil fire retardant poly on the floors and two layers of 4 mil, fire retardant poly on the walls, unless otherwise directed in writing by the VA representative. Floor layers must form a right angle with the wall and turn up the wall at least 300 mm (12"). Seams must overlap at least 1800 mm (6') and must be spray glued and taped. Install sheeting so that layers can be removed independently from each other. Carpeting shall be covered with three layers of 6 mil poly. Corrugated cardboard sheets must be placed between the bottom and middle layers of poly. Mechanically support and seal with duct tape and glue all wall layers.
- B. Elevator doors must be covered with 2 layers of 6 mil fire retardant poly. The elevator door must be in a positively pressurized area outside the clean room of the PDF.
- C. If stairs and ramps are covered with 6 mil plastic, two layers must be used. Provide 19 mm (3/4") exterior grade plywood treads held in place with duct tape/glue on the plastic. Do not cover rungs or rails with any isolation materials.

2.2.6 SECONDARY BARRIERS

A loose layer of 6 mil poly shall be used as a drop cloth to protect the primary layers from debris generated during the abatement. This layer shall be replaced as needed during the work and at a minimum once per work day.

2.2.7 EXTENSION OF THE REGULATED AREA

If the enclosure of the regulated area is breached in any way that could allow contamination to occur, the affected area shall be included in the regulated area and constructed as per this section. Decontamination measures must be started immediately and continue until air monitoring indicates background levels are met.

2.2.8 FIRESTOPPING

- A. Through penetrations caused by cables, cable trays, pipes, sleeves, conduits, etc. must be firestopped with a fire-rated firestop system providing an air tight seal.
- B. Firestop materials that are not equal to the wall or ceiling penetrated shall be brought to the attention of the VA Representative. The contractor shall list all areas of penetration, the type of sealant used, and whether or not the location is fire rated. Any discovery of penetrations during abatement shall be brought to the attention of the VA representative immediately. All walls, floors and ceilings are

considered fire rated unless otherwise determined by the VA Representative or Fire Marshall.

- C. Any visible openings whether or not caused by a penetration shall be reported by the Contractor to the VA Representative for a sealant system determination. Firestops shall meet ASTM E814 and UL 1479 requirements for the opening size, penetrant, and fire rating needed

2.3 MONITORING, INSPECTION AND TESTING

2.3.1 GENERAL

- A. Perform throughout abatement work monitoring, inspection and testing inside and around the regulated area in accordance with the OSHA requirements and these specifications. OSHA requires that the Employee exposure to asbestos must not exceed 0.1 fibers per cubic centimeter (f/cc) of air, averaged over an 8-hour work shift. The CPIH/CIH is responsible for and shall inspect and oversee the performance of the Contractor IH Technician. The IH Technician shall continuously inspect and monitor conditions inside the regulated area to ensure compliance with these specifications. In addition, the CPIH/CIH shall personally manage air sample collection, analysis, and evaluation for personnel, regulated area, and adjacent area samples to satisfy OSHA requirements. Additional inspection and testing requirements are also indicated in other parts of this specification.
- B. The VA will employ an independent industrial hygienist (VPIH/CIH) consultant and/or use its own IH to perform various services on behalf of the VA. The VPIH/CIH will perform the necessary monitoring, inspection, testing, and other support services to ensure that VA patients, employees, and visitors will not be adversely affected by the abatement work, and that the abatement work proceeds in accordance with these specifications, that the abated areas or abated buildings have been successfully decontaminated. The work of the VPIH/CIH consultant in no way relieves the Contractor from their responsibility to perform the work in accordance with contract/specification requirements, to perform continuous inspection, monitoring and testing for the safety of their employees, and to perform other such services as specified. The cost of the VPIH/CIH and their services will be borne by the VA except for any repeat of final inspection and testing that may be required due to unsatisfactory initial results. Any repeated final inspections and/or testing, if required, will be paid for by the Contractor.
- C. If fibers counted by the VPIH/CIH during abatement work, either inside or outside the regulated area, utilizing the NIOSH 7400 air monitoring method, exceed the specified respective limits, the Contractor shall stop work. The Contractor may request confirmation of the results by analysis of the samples by TEM. Request must be in writing and submitted to the VA's representative. Cost for the confirmation of results will be borne by the Contractor for both the collection and analysis of samples and for the time delay that may/does result for this confirmation. Confirmation sampling and analysis will be the responsibility of the CPIH with review and approval of the VPIH/CIH. An agreement between the CPIH/CIH and the VPIH/CIH shall be reached on the exact details of the confirmation effort, in writing, including such things as the number of samples, location, collection, quality control on-site, analytical laboratory, interpretation of results and any follow-up actions. This written agreement shall be co-signed by the IH's and delivered to the VA's representative.

2.3.2 SCOPE OF SERVICES OF THE VPIH CONSULTANT

- A. The purpose of the work of the VPIH/CIH is to: assure quality; adherence to the specification; resolve problems; prevent the spread of contamination beyond the regulated area; and assure clearance at the end of the project. In addition, their work includes performing the final inspection and testing to determine whether the regulated area or building has been adequately decontaminated. All air monitoring is to be done utilizing PCM/TEM. The VPIH/CIH will perform the following tasks:
1. Task 1: Establish background levels before abatement begins by collecting background samples. Retain samples for possible TEM analysis.
 2. Task 2: Perform continuous air monitoring, inspection, and testing outside the regulated area during actual abatement work to detect any faults in the regulated area isolation and any adverse impact on the surroundings from regulated area activities.
 3. Task 3: Perform unannounced visits to spot check overall compliance of work with contract/specifications. These visits may include any inspection, monitoring, and testing inside and outside the regulated area and all aspects of the operation except personnel monitoring.
 4. Task 4: Provide support to the VA representative such as evaluation of submittals from the Contractor, resolution of conflicts, interpret data, etc.
 5. Task 5: Perform, in the presence of the VA representative, final inspection and testing of a decontaminated regulated area at the conclusion of the abatement to certify compliance with all regulations and VA requirements/specifications.
 6. Task 6: Issue certificate of decontamination for each regulated area and project report.
- B. All documentation, inspection results and testing results generated by the VPIH/CIH will be available to the Contractor for information and consideration. The Contractor shall cooperate with and support the VPIH/CIH for efficient and smooth performance of their work.
- C. The monitoring and inspection results of the VPIH/CIH will be used by the VA to issue any Stop Removal orders to the Contractor during abatement work and to accept or reject a regulated area or building as decontaminated..
- D. All air sampling and analysis data will be recorded on VA Form 10-0018.

2.3.3 MONITORING, INSPECTION AND TESTING BY CONTRACTOR CPIH/CIH

The Contractor's CPIH/CIH is responsible for managing all monitoring, inspections, and testing required by these specifications, as well as any and all regulatory requirements adopted by these specifications. The CPIH/CIH is responsible for the continuous monitoring of all subsystems and procedures which could affect the health and safety of the Contractor's personnel. Safety and health conditions and the provision of those conditions inside the regulated area for all persons entering the regulated area is the exclusive responsibility of the Contractor/Competent Person. The person performing the personnel and area air monitoring inside the regulated area shall be an IH Technician, who shall be trained and shall have specialized field experience in sampling and analysis. The IH Technician shall have

successfully completed a NIOSH 582 Course or equivalent and provide documentation. The IH Technician shall participate in the AIHA Asbestos

Analysis Registry or participate in the Proficiency Analytic Testing program of AIHA for fiber counting quality control assurance. The IH Technician shall also be an accredited EPA AHERA/State Contractor/Supervisor or Abatement Worker and Building Inspector. The IH Technician shall have participated in five abatement projects collecting personal and area samples as well as responsibility for documentation on substantially similar projects in size and scope. The analytic laboratory used by the Contractor to analyze the samples shall be AIHA accredited for asbestos PAT and approved by the VA prior to start of the project. A daily log, shall be maintained by the CPIH/CIH or IH Technician, documenting all OSHA requirements for air personal monitoring for asbestos in 29 CFR 1926.1101(f), (g) and Appendix A. This log shall be made available to the VA representative and the VPIH/CIH upon request. The log will contain, at a minimum, information on personnel or area samples, other persons represented by the sample, the date of sample collection, start and stop times for sampling, sample volume, flow rate, and fibers/cc. The CPIH/CIH shall collect and analyze samples for each representative job being done in the regulated area, i.e., removal, wetting, clean-up, and load-out. No fewer than two personal samples per shift shall be collected and one area sample per 1,000 square feet of regulated area where abatement is taking place and one sample per shift in the clean room area shall be collected. In addition to the continuous monitoring required, the CPIH/CIH will perform inspection and testing at the final stages of abatement for each regulated area as specified in the CPIH/CIH responsibilities. Additionally, the CPIH/CIH will monitor and record pressure readings within the containment daily with a minimum of two readings at the beginning and at the end of a shift, and submit the data in the daily report.

2.4 ASBESTOS HAZARD ABATEMENT PLAN

The Contractor shall have established Asbestos Hazard Abatement Plan (AHAP) in printed form and loose leaf folder consisting of simplified text, diagrams, sketches, and pictures that establish and explain clearly the procedures to be followed during all phases of the work by the Contractor's personnel. The AHAP must be modified as needed to address specific requirements of this project and the specifications. The AHAP(s) shall be submitted for review and approval to the VA prior to the start of any abatement work. The minimum topics and areas to be covered by the AHAP(s) are:

- A. Minimum Personnel Qualifications.
- B. Contingency Plans and Arrangements.
- C. Security and Safety Procedures.
- D. Respiratory Protection/Personal Protective Equipment Program and Training.
- E. Medical Surveillance Program and Recordkeeping.
- F. Regulated Area Requirements - Containment Barriers/Isolation of Regulated Area.
- G. Decontamination Facilities and Entry/Exit Procedures (PDF and EWDF).
- H. Negative Pressure Systems Requirements.
- I. Monitoring, Inspections, and Testing.

02 82 13.41 - 32

07-11

- J. Removal Procedures for RACM and ACE.
- K. Removal Procedures for RACM discovered during building demolition shall be provided as per NESHAP.

- L. Removal of Contaminated Soil (if applicable).
- M. Abatement of crawlspaces and/or pipe tunnels if they exist within the facility.
- N. Disposal of RACM and ACE as per NESHAP; OSHA; and DOT for friable asbestos including NESHAP/DOT shipping papers example. Disposal requirements for non-friable waste, as per OSHA requirements.
- O. Regulated Area Decontamination/Clean-up.
- P. Regulated Area Visual and Air Clearance, if required.
- Q. Project Completion/Closeout.

2.5 SUBMITTALS

2.5.1 PRE-CONSTRUCTION MEETING SUBMITTALS

Submit to the VA a minimum of 14 days prior to the pre-start meeting the following for review and approval. Meeting this requirement is a prerequisite for the pre-start meeting for this project:

- A. Submit a detailed work schedule for the entire project reflecting contract documents and the phasing/schedule requirements from the CPM chart.
- B. Submit a staff organization chart showing all personnel who will be working on the project and their capacity/function. Provide their qualifications, training, accreditations, and licenses, as appropriate. Provide a copy of the "Certificate of Worker's Acknowledgment" and the "Affidavit of Medical Surveillance and Respiratory Protection" for each person.
- C. Submit Asbestos Hazard Abatement Plan developed specifically for this project, incorporating the requirements of the specifications, prepared, signed and dated by the CPIH/CIH.
- D. Submit the specifics of the materials and equipment to be used for this project with manufacturer names, model numbers, performance characteristics, pictures/diagrams, and number available for the following:
 - 1. Supplied air system, negative air machines, HEPA vacuums, air monitoring pumps, calibration devices, pressure differential monitoring device and emergency power generating system.
 - 2. Waste water filtration system, shower system, containment barriers.
 - 3. Encapsulants, surfactants, hand held sprayers, airless sprayers, glovebags, and fire extinguishers.
 - 4. Respirators, protective clothing, personal protective equipment.
 - 5. Fire safety equipment to be used in the regulated area.
- E. Submit the name, location, and phone number of the approved landfill; proof/verification the landfill is approved for ACM disposal; the landfill's requirements for ACM waste; the type of vehicle to be used for transportation; and name, address, and phone number of subcontractor, if used. Proof of asbestos training for transportation personnel shall be provided.
- F. Submit required notifications and arrangements made with regulatory agencies having regulatory jurisdiction and the specific contingency/emergency arrangements made with local health, fire, ambulance, hospital authorities and any other notifications/arrangements.

- G. Submit the name, location and verification of the laboratory and/or personnel to be used for analysis of air and/or bulk samples. Personal air monitoring must be done in accordance with OSHA 29 CFR 1926.1101(f) and Appendix A. And area or clearance air monitoring in accordance with EPA AHERA protocols.
- H. Submit qualifications verification: Submit the following evidence of qualifications. Make sure that all references are current and verifiable by providing current phone numbers and documentation.
1. Asbestos Abatement Company: Project experience within the past 3 years; listing projects first most similar to this project: Project Name; Type of Abatement; Duration; Cost; Reference Name/Phone Number; Final Clearance; Completion Date
 2. List of project(s) halted by owner, A/E, IH, regulatory agency in the last 3 years: Project Name; Reason; Date; Reference Name/Number; Resolution
 3. List asbestos regulatory citations (e.g., OSHA), notices of violations (e.g., Federal and state EPA), penalties, and legal actions taken against the company including and of the company's officers (including damages paid) in the last 3 years. Provide copies and all information needed for verification.
- I. Submit information on personnel: Provide a resume; address each item completely; copies of certificates, accreditations, and licenses. Submit an affidavit signed by the CPIH/CIH stating that all personnel submitted below have medical records in accordance with OSHA 29 CFR 1926.1101(m) and 29 CFR 1910.20 and that the company has implemented a medical surveillance program and written respiratory protection program, and maintains recordkeeping in accordance with the above regulations. Submit the phone number and doctor/clinic/hospital used for medical evaluations.
1. CPIH/CIH and IH Technician: Name; years of abatement experience; list of projects similar to this one; certificates, licenses, accreditations for proof of AHERA/OSHA specialized asbestos training; professional affiliations; number of workers trained; samples of training materials; samples of AHAP(s) developed; medical opinion; and current respirator fit test.
 2. Competent Person(s)/Supervisor(s): Number; names; social security numbers; years of abatement experience as Competent Person/Supervisor; list of similar projects in size/complexity as Competent Person/Supervisor; as a worker; certificates, licenses, accreditations; proof of AHERA/OSHA specialized asbestos training; maximum number of personnel supervised on a project; medical opinion (asbestos surveillance and respirator use); and current respirator fit test.
 3. Workers: Numbers; names; social security numbers; years of abatement experience; certificates, licenses, accreditations; training courses in asbestos abatement and respiratory protection; medical opinion (asbestos surveillance and respirator use); and current respirator fit test.
- J. Submit copies of State license for asbestos abatement; copy of insurance policy, including exclusions with a letter from agent stating in plain language the coverage provided and the fact that asbestos abatement activities are covered by the policy; copy of AHAP(s) incorporating the requirements of this specification; information on who provides your training, how often; who provides medical surveillance, how often; who performs and how is personal air

monitoring of abatement workers conducted; a list of references of independent laboratories/IHs familiar with your air monitoring and AHAP(s); and copies of monitoring results of the five referenced projects listed and analytical method(s) used.

- K. Rented equipment must be decontaminated prior to returning to the rental agency.
- L. Submit, before the start of work, the manufacturer's technical data for all types of encapsulants, all MSDS and application instructions.

2.5.2 SUBMITTALS DURING ABATEMENT

- A. The Competent Person shall maintain and submit a daily log at the regulated area documenting the dates and times of the following: purpose, attendees and summary of meetings; all personnel entering/exiting the regulated area; document and discuss the resolution of unusual events such as barrier breaching, equipment failures, emergencies, and any cause for stopping work; representative air monitoring and results/TWA's/EL's. Submit this information daily to the VPIH/CIH.
- B. The CPIH/CIH shall document and maintain the inspection and approval of the regulated area preparation prior to start of work and daily during work:
 1. Inspection and approval of the regulated area preparation prior to start of work and daily during work.
 2. Removal of any poly barriers.
 3. Visual inspection/testing by the CPIH/CIH or IH Technician prior to application of lockdown encapsulant.
 4. Packaging and removal of ACM waste from regulated area.
 5. Disposal of ACM waste materials; copies of Waste Shipment Records/landfill receipts to the VA's representative on a weekly basis.

2.5.3 SUBMITTALS AT COMPLETION OF ABATEMENT

The CPIH/CIH shall submit a project report consisting of the daily log book requirements and documentation of events during the abatement project including Waste Shipment Records signed by the landfill's agent. It will also include information on the containment and transportation of waste from the containment with applicable Chain of Custody forms. The report shall include a certificate of completion, signed and dated by the CPIH/CIH, in accordance with Attachment #1. All clearance and perimeter area samples must be submitted. The VA Representative will retain the abatement report after completion of the project and provide copies of the abatement report to VAMC Office of Engineer and the Safety Office.

PART 3 - EXECUTION

3.1 PRE-ABATEMENT ACTIVITIES

3.1.1 PRE-ABATEMENT MEETING

The VA representative, upon receipt, review, and substantial approval of all pre-abatement submittals and verification by the CPIH/CIH that all materials and equipment required for the project are on the site, will arrange for a pre-abatement meeting between the Contractor, the

CPIH/CIH, Competent Person(s), the VA representative(s), and the VPIH/CIH. The purpose of the meeting is to discuss any aspect of the submittals needing clarification or amplification and to discuss any aspect of the project execution and the sequence of the operation. The Contractor shall be prepared to provide any supplemental information/documentation to the VA's representative regarding any submittals, documentation, materials or equipment. Upon satisfactory resolution of any outstanding issues, the VA's representative will issue a written order to proceed to the Contractor. No abatement work of any kind described in the following provisions shall be initiated prior to the VA written order to proceed.

3.1.2 PRE-ABATEMENT INSPECTIONS AND PREPARATIONS

- A. Perform all preparatory work for the first regulated area in accordance with the approved work schedule and with this specification.
- B. Upon completion of all preparatory work, the CPIH/CIH will inspect the work and systems and will notify the VA's representative when the work is completed in accordance with this specification. The VA's representative may inspect the regulated area and the systems with the VPIH/CIH and may require that upon satisfactory inspection, the Contractor's employees perform all major aspects of the approved AHAP, especially worker protection, respiratory systems, contingency plans, decontamination procedures, and monitoring to demonstrate satisfactory operation. The operational systems for respiratory protection and the negative pressure system shall be demonstrated for proper performance.
- C. The CPIH/CIH shall document the pre-abatement activities described above and deliver a copy to the VA's representative.
- D. Upon satisfactory inspection of the installation of and operation of systems the VA's representative will notify the Contractor in writing to proceed with the asbestos abatement work in accordance with this specification and all applicable regulations.

3.1.3 PRE-ABATEMENT CONSTRUCTION AND OPERATIONS

- A. Perform all preparatory work for the first regulated area in accordance with the approved work schedule and with this specification.
- B. Upon completion of all preparatory work, the CPIH will inspect the work and systems and will notify the VA's representative when the work is completed in accordance with this specification. The VA's representative may inspect the regulated area and the systems with the VPIH and may require that upon satisfactory inspection, the abatement contractor's employees perform all major aspects of the approved AHAP, especially worker protection, respiratory systems, contingency plans, decontamination procedures, and monitoring to demonstrate satisfactory operation. The operational systems for respiratory protection and the negative pressure system shall be demonstrated for proper performance.
- C. The CPIH/CIH shall document the pre-abatement activities described above and deliver a copy to the VA's representative.

- D. Upon satisfactory inspection of the installation of and operation of systems the VA's representative will notify the abatement contractor in writing to proceed with the asbestos abatement work in accordance with this specification.

3.2 REGULATED AREA PREPARATIONS

- A. Post OSHA DANGER signs meeting the specifications of OSHA 29 CFR 1926.1101 at any location and approaches to the regulated area where airborne concentrations of asbestos may exceed the PEL. Signs shall be posted at a distance sufficiently far enough away from the regulated area to permit any personnel to read the sign and take the necessary measures to avoid exposure. Additional signs will be posted following construction of the regulated area enclosure.
- B. Shut down and lock out/tag out electric power to the regulated area. Provide temporary power and lighting. Insure safe installation including GFCI of temporary power sources and equipment by compliance with all applicable electrical code and OSHA requirements for temporary electrical systems. Electricity shall be provided by the VA.
- C. Shut down and lock out/tag out heating, cooling, and air conditioning system (HVAC) components that are in, supply or pass through the regulated area. Investigate the regulated area and agree on pre-abatement condition with the VA's representative. Seal all intake and exhaust vents in the regulated area with duct tape and 2 layers of 6-mil poly. Also, seal any seams in system components that pass through the regulated area. Remove all contaminated HVAC system filters and place in labeled 6-mil polyethylene disposal bags for staging and eventual disposal as asbestos waste.
- D. The Contractor shall provide sanitary facilities for abatement personnel and maintain them in a clean and sanitary condition throughout the abatement project.
- E. The VA will provide water for abatement purposes. The Contractor shall connect to the existing VA system. The service to the shower(s) shall be supplied with backflow prevention. The Contractor shall be responsible for hot water provision to the shower(s).
- F. The Contractor shall not allow unauthorized persons into the regulated area without the written permission of the VPIH.

3.3 CONTAINMENT COVERINGS FOR THE REGULATED AREA

3.3.1 GENERAL

Seal off the perimeter of the regulated area to completely isolate the abatement project and to contain all airborne asbestos contamination created by the abatement activities. Should the adjacent area past the regulated area become contaminated due to improper work activities, the abatement contractor shall suspend work inside the regulated area, continue wetting, and clean the adjacent areas in accordance with procedures described in these specifications. Any and all costs associated with the adjacent area cleanup shall not be borne by the VA.

3.3.2 PREPARATION PRIOR TO SEALING OFF

Place all materials, equipment and supplies necessary to isolate the regulated area inside the regulated area. Remove all movable material/equipment as described above and secure all unmovable material/equipment as described above. Properly secured

material/equipment shall be considered to be outside the regulated area.

3.3.3 CONTROLLING ACCESS TO THE REGULATED AREA

Access to the regulated area shall be permitted only through the PDF. All other means of access shall be closed off by proper sealing and DANGER signs posted on the clean side of the regulated area where it is adjacent to or within view of any occupiable area. An opaque visual barrier of at least 4 mil poly shall be provided so that the abatement work is not visible to any building occupants. If the area adjacent to the regulated area is accessible to the public, construct a solid barrier on the public side of the sheeting for protection and isolation of the project. The barrier shall be constructed with nominal 2" x 4" (50mm x 100mm) wood or metal studs 16" (400mm) on centers, securely anchored to prevent movement and covered with a minimum of 1/2" (12.5mm) plywood. Provide an appropriate number of OSHA DANGER signs for each visual and physical barrier. Any alternative method must be given a written approval by the VA's representative.

3.3.4 CRITICAL BARRIERS

The regulated area must be completely separated from the adjacent areas, and the outside by at least 2 layers of 6 mil, fire retardant poly and duct tape/spray adhesive. Individually seal all supply and exhaust ventilation openings, lighting fixtures, clocks, doorways, windows, convectors, speakers, and other openings into the regulated area with 2 layers of 6 mil fire retardant poly, and taped securely in place with duct tape/spray adhesive. Critical barriers must remain in place until all work and clearances have been completed. Light fixtures shall not be operational during abatement. Auxiliary lighting shall be provided. If needed, provide plywood squares 6" x 6" x 3/8" (150mm x 150mm x 18mm) held in place with one 6d smooth masonry/galvanized nail driven through the center of the plywood square and duct tape on the poly so as to clamp the poly to the wall/surface. Locate plywood squares at each end, corner, and 4' (1200mm) maximum on centers.

3.3.5 PRIMARY/SECONDARY BARRIERS

- A. Floors: Cover the floor of the regulated area with at least two layers of 6 mil, fire retardant poly, turning up the walls at least 12" (300mm). The poly must form a right angle at the floor-wall juncture so there is no radius which can be stepped on, possibly causing detachment of the poly. Spray glue and duct tape must both be used for floor seams. Floor seams must overlap a minimum of 6 feet (1800mm) or be at right angles to each other. The top sheet of poly must be able to be removed independently of the bottom layer. A third loose layer of 6 mil poly shall be used in the area of removal and periodically picked up to reduce contamination of the initial layers.
 - B. Walls: All walls in the regulated area, including critical barriers, shall be covered with 2 layers of 4 mil fire retardant poly, mechanically supported and sealed with duct tape and/or spray glue. Tape all joints, including the floor-wall joint, with duct tape/spray glue. All wall joints must overlap at least 6 feet (1800mm).
- NOTE: The VA or State requirements may require the use of 6 mil poly.

- C. Stairs and Ramps: Stairs or ramps covered in poly must be provided with 3/4" (36mm) exterior grade plywood treads securely held in place over the poly. Do not cover stairs or ramps with unsecured poly. Do not cover rungs or rails with any protective materials.

3.3.6 EXTENSION OF THE REGULATED AREA

If the regulated area barrier is breached in any manner that could allow the passage of asbestos fibers or debris, the Competent Person shall immediately stop work, continue wetting, and proceed to extend the regulated area to enclose the affected area as per procedures described in this specification. If the affected area cannot be enclosed, decontamination measures and cleanup shall start immediately. All personnel shall be isolated from the affected area until decontamination/cleanup is completed as verified by visual inspection and air monitoring. Air monitoring at completion must indicate background levels.

3.4 REMOVAL OF RACM AND ACE

3.4.1 WETTING MATERIALS

- A. Use amended water for the wetting of ACM prior to removal. The Competent Person shall assure the wetting of ACM meets the definition of "adequately wet" in the EPA NESHAP regulation for the duration of the project. A removal encapsulant may be used instead of amended water with written approval of the VA's representative.
- B. Amended Water: Provide water to which a surfactant has been added shall be used to wet the ACM and reduce the potential for fiber release during disturbance of ACM. The mixture must be equal to or greater than the wetting provided by water amended by a surfactant consisting one ounce of 50% polyoxyethylene ester and 50% polyoxyethylene ether mixed with 5 gallons (19L) of water.

3.4.2 WET REMOVAL OF ACM OTHER THAN AMOSITE

- A. Adequately and thoroughly wet the ACM to be removed prior to removal to reduce/prevent fiber release to the air. Adequate time must be allowed for the amended water to saturate the ACM. Abatement personnel must not disturb dry ACM. Use a fine spray of amended water or removal encapsulant. Saturate the material sufficiently to wet to the substrate without causing excessive dripping. The material must be sprayed repeatedly/continuously during the removal process in order to maintain adequately wet conditions. Removal encapsulants must be applied in accordance with the manufacturer's written instructions. Perforate or carefully separate, using wet methods, an outer covering that is painted or jacketed in order to allow penetration and wetting of the material. Where necessary, carefully remove covering while wetting to minimize fiber release. **In no event shall dry removal occur except in the case of electrical hazards or a greater safety issue is possible!**
- B. If ACM does not wet well with amended water due to coating or jacketing, remove as follows:
1. Mist work area continuously with amended water whenever necessary to reduce airborne fiber levels.
 2. Remove saturated ACM in small sections. Do not allow material to dry out. As material is removed, bag material, while still wet into

- disposal bags. Twist the bag neck tightly, bend over (gooseneck) and seal with a minimum of three tight wraps of duct tape. Clean /decontaminate the outside of the bag of any residue and move to washdown station adjacent to W/EDF.
3. Fireproofing or Architectural Finish on Scratch Coat: Spray with a fine mist of amended water or removal encapsulant. Allow time for saturation to the substrate. Do not oversaturate causing excess dripping. Scrape material from substrate. Remove material in manageable quantities and control falling to staging or floor. If the falling distance is over 20 feet (6 meters), use a drop chute to contain material through descent. Remove residue remaining on the scratch coat after scraping is done using a stiff bristle hand brush. If a removal encapsulant is used, remove residue completely before the encapsulant dries. Periodically re-wet the substrate with amended water as needed to prevent drying of the material before the residue is removed from the substrate.
 4. Fireproofing or Architectural Finish on Wire Lath: Spray with a fine mist of amended water or removal encapsulant. Allow time to completely saturate the material. Do not oversaturate causing excess dripping. If the surface has been painted or otherwise coated, cut small holes as needed and apply amended water or removal encapsulant from above. Cut saturated wire lath into 2' x 6' (50mm x 150mm) sections and cut hanger wires. Roll up complete with ACM, cover in burlap and hand place in disposal bag. Do not drop to floor. After removal of lath/ACM, remove any overspray on decking and structure using stiff bristle nylon brushes. Depending on hardness of overspray, scrapers may be needed for removal.
 5. Pipe/Tank/Vessel/Boiler Insulation: Remove the outer layer of wrap while spraying with amended water in order to saturate the ACM. Spray ACM with a fine mist of amended water or removal encapsulant. Allow time to saturate the material to the substrate. Cut bands holding pre-formed pipe insulation sections. Slit jacketing at the seams, remove and hand place in a disposal bag. Do not allow dropping to the floor. Remove molded fitting insulation/mud in large pieces and hand place in a disposal bag. Remove any residue on pipe or fitting with a stiff bristle nylon brush. In locations where pipe fitting insulation is removed from fibrous glass or other non-asbestos insulated straight runs of pipe, remove fibrous material at least 6" from the point it contacts the ACM.

3.4.3 WET REMOVAL OF AMOSITE

- B. Provide local exhaust ventilation and collection systems to assure collection of amosite fibers at the point of generation. A 300 mm (12") flexible rigid non-collapsing duct shall be located no more than 600 mm (2') from any scraping/brushing activity. Primary filters must be replaced every 30 minutes on the negative air machines. Each scraping/brushing activity must have a negative air machine devoted to it. For pre-molded pipe insulation or cutting wire lathe attach a 1200 mm (4') square flared end piece on the intake of the duct. Support the duct horizontally at a point 600 mm (2') below the work to effect capture. One person in the crew shall be assigned to operate the duct collection system on a continual basis.
- C. Amosite does not wet well with amended water. Submit full information/documentation on the wetting agent proposed prior to start

for review and approval by the VA Representative. Insure that the material is worked on in small sections and is thoroughly and continuously wetted. Package as soon as possible while wet. Remove as required.

//3.4.4 REMOVAL OF RACM CONTAMINATED SOIL AND OTHER SPECIAL PROCEDURES:

- A. CPIH shall develop and submit a detailed procedure for removal of RACM contaminated soil for review and approval prior to commencing with removal.
- B. Removal of contaminated soil:
When working on soil contamination, pick up all visible asbestos debris using wet methods if possible after set-up of PDF, EWDF, negative air systems as required. Perform work and decontaminate/clean-up; and complete work as required in these specifications.

3.4.5 GLOVEBAG REMOVAL PROCEDURES

GENERAL: All applicable OSHA requirements and the VA 01570 Specification for glovebag removal shall be followed. The Contractor's AHAP for glovebag removal shall minimally meet the above requirements.

3.5 DISPOSAL OF RACM AND ACE WASTE MATERIALS

3.5.1 GENERAL

The VA must be notified at least 24 hours in advance of any waste removed from the containment. Dispose of waste ACM and debris which is packaged in accordance with these specifications, OSHA, EPA and DOT. The landfill requirements for packaging must also be met. Transport will be in compliance with 49 CFR 100-185 regulations. Disposal shall be done at an approved landfill. Disposal of non-friable ACM shall be done in accordance with applicable regulations.

3.5.2 PROCEDURES

- A. Asbestos waste shall be packaged and moved through the W/EDF into a covered transport container in accordance with procedures in this specification. Waste shall be double-bagged prior to disposal. Wetted waste can be very heavy. Bags shall not be overfilled. Bags shall be securely sealed to prevent accidental opening and/or leakage. The top shall be tightly twisted and goose necked prior to tightly sealing with at least three wraps of duct tape. Ensure that unauthorized persons do not have access to the waste material once it is outside the regulated area. All transport containers must be covered at all times when not in use. NESHAP signs must be on containers during loading and unloading. Material shall not be transported in open vehicles. If drums are used for packaging, the drums shall be labeled properly and shall not be re-used.
- B. Waste Load Out: Waste load out shall be done in accordance with the procedures in W/EDF Decontamination Procedures. Bags shall be decontaminated on exterior surfaces by wet cleaning and/or HEPA vacuuming before being placed in the second bag.
- C. Asbestos waste with sharp edged components, i.e., nails, screws, lath, strapping, tin sheeting, jacketing, metal mesh, etc., which might tear poly bags shall be wrapped securely in burlap before packaging and, if

needed, use a poly lined fiber drum as the second container, prior to disposal.

- D. The VA will be notified of any waste removed from the containment prior to 24 hours.

3.6 PROJECT DECONTAMINATION

3.6.1 GENERAL

The entire work related to project decontamination shall be performed under the close supervision and monitoring of the CPIH/CIH.

3.6.2 REGULATED AREA CLEARANCE

Air testing and other requirements which must be met before release of the Abatement Contractor are specified in Final Testing Procedures.

3.6.3 WORK DESCRIPTION

Decontamination includes the cleaning and clearance of the air in the regulated area and the decontamination and removal of the enclosures/facilities installed prior to the abatement work including primary/critical barriers, PDF and EWDF facilities, and negative pressure systems.

3.6.4 PRE-DECONTAMINATION CONDITIONS

- A. Before decontamination starts, all ACM and ACE from the regulated area shall be removed, all waste collected and removed, and the secondary barrier of poly removed and disposed of along with any gross debris generated by the work.
- B. At the start of decontamination, the following shall be in place:
1. Primary barriers consisting of two layers of 6 mil poly on the floor and on the walls.
 2. Critical barriers consisting of two layers of 6 mil poly which is the sole barrier between the regulated area and the rest of the building or outside.
 3. Critical barrier poly over lighting fixtures, clocks, HVAC openings, doorways, windows, convectors, speakers and other openings in the regulated area.
 4. Decontamination facilities for personnel and equipment in operating condition and the negative pressure system in operation.

3.6.5 CLEANING

Carry out a first cleaning of all surfaces of the regulated area including items of remaining poly sheeting, tools, scaffolding, ladders/staging by wet methods and/or HEPA vacuuming. Do not use dry dusting/sweeping/air blowing methods. Use each surface of a wetted cleaning cloth one time only and then dispose of as contaminated waste. Continue this cleaning until there is no visible residue from abated surfaces or poly or other surfaces. Remove all filters in the air handling system and dispose of as ACM waste in accordance with these specifications. The negative pressure system shall remain in operation during this time.

3.7 VISUAL INSPECTION AND AIR CLEARANCE

TESTING 3.7.1 GENERAL

Notify the VA representative 24 hours in advance for the performance of the visual inspection and air clearance testing, if required. The visual inspection and air clearance testing, if needed, will be performed by the VPIH after the CPIH has performed final air clearance testing, if needed.

3.7.2 VISUAL INSPECTION

The CPIH/CIH and VPIH/CIH will perform a thorough and detailed visual inspection at the end of the cleaning to determine whether there is any visible residue in the regulated area. If the visual inspection is acceptable, the CPIH/CIH will perform pre-clearance sampling using aggressive clearance as detailed in 40 CFR 763 Subpart E (AHERA) Appendix A (III)(B)(7)(d). If the sampling results show values below 0.01 f/cc, then the Contractor shall notify the VA's representative of the results with a brief report from the CPIH/CIH documenting the inspection and sampling results and a statement verifying that the regulated area is ready for lockdown encapsulation. The VA reserves the right to utilize their own VPIH/CIH to perform a pre-clearance inspection and testing for verification.

3.7.3 AIR CLEARANCE TESTING

- A. Since the areas will not be re-occupied by personnel after the completion of the abatement, air clearance testing is not required under OSHA/EPA AHERA. States may have rules for clearance testing that might require testing. Consult State rules for the facility and perform clearance testing if needed. After an acceptable visual inspection by the VPIH and VA Representative, the VPIH will perform the final testing. If the release criteria are not met, the Abatement Contractor shall repeat the final cleaning and continue decontamination procedures. Additional inspection and testing will be done at the expense of the Abatement Contractor.
- B. If release criteria are met, proceed to perform the abatement closeout and to issue the certificate of completion in accordance with these specifications.

3.7.4 AIR CLEARANCE PROCEDURES

- A. Contractor's Release Criteria: Work in a regulated area is complete when the regulated area is visually clean and airborne fiber levels have been reduced to or below 0.01 f/cc, as measured by PCM methods, if required.
- B. Final Clearance Sampling: If required, the VPIH will secure samples and analyze them according to the NIOSH 7400 method. Samples must be confirmed at an AIHA accredited laboratory if samples are analyzed on-site.

3.7.5 CLEARANCE SAMPLING USING PCM

- A. If required, and after the CPIH/CIH has provided clearance monitoring, the VPIH will perform background, adjacent area, and regulated area samples during construction, and clearance samples as directed by the VA Representative.

- B. The NIOSH 7400 method will be used for clearance sampling with a minimum collection volume based on a fiber density of 100 to 1300 fibers/sq. mm, (0.79 - 10.2 fibers/field) and a minimum detection limit of 0.005 f/cc or less.

3.8 ABATEMENT CLOSEOUT AND CERTIFICATE OF COMPLIANCE

3.8.1 COMPLETION OF ABATEMENT WORK

- A. After thorough decontamination, seal negative air machines with 2 layers of 6 mil poly and duct tape to form a tight seal at the intake/outlet ends before removal from the regulated area. Complete asbestos abatement work upon meeting the regulated area visual and air clearance criteria and fulfilling the following:
- B. Remove all equipment and materials from the project area.
- C. Dispose of all packaged ACM waste as required.
- D. Repair or replace all interior finishes damaged during the abatement work, as required.
- E. Fulfill other project closeout requirements as required in this specification.

3.8.2 CERTIFICATE OF COMPLETION BY CONTRACTOR

- A. The CPIH/CIH shall complete and sign the "Certificate of Completion" in accordance with Attachment 1 at the completion of the abatement and decontamination of the regulated area.

3.8.3 WORK SHIFTS

- A. Comply with work schedules listed in General Requirements. Any change in the work schedule must be approved in writing by the VA Representative.

ATTACHMENT #1

CERTIFICATE OF COMPLETION

DATE: VA Project #: _____

PROJECT NAME: _____ Abatement Contractor: _____

VAMC/ADDRESS: _____

1. I certify that I have personally inspected, monitored and supervised the abatement work of (specify regulated area or Building):
which took place from / / to / /
2. That throughout the work all applicable requirements/regulations and the VA's specifications were met.
3. That any person who entered the regulated area was protected with the appropriate personal protective equipment and respirator and that they followed the proper entry and exit procedures and the proper operating procedures for the duration of the work.
4. That all employees of the Abatement Contractor engaged in this work were trained in respiratory protection, were experienced with abatement work, had proper medical surveillance documentation, were fit-tested for their respirator, and were not exposed at any time during the work to asbestos without the benefit of appropriate respiratory protection.
5. That I performed and supervised all inspection and testing specified and required by applicable regulations and VA specifications.
6. That the conditions inside the regulated area were always maintained in a safe and healthy condition and the maximum fiber count never exceeded 0.5 f/cc, except as described below.
7. That all abatement work was done in accordance with OSHA requirements and the manufacturer's recommendations.

CPIH/CIH Signature/Date: _____

CPIH/CIH Print Name: _____

Abatement Contractor Signature/Date: _____

Abatement Contractor Print Name: _____

ATTACHMENT #2

CERTIFICATE OF WORKER'S ACKNOWLEDGMENT

PROJECT NAME: _____ DATE: _____

PROJECT ADDRESS: _____

ABATEMENT CONTRACTOR'S NAME: _____

WORKING WITH ASBESTOS CAN BE HAZARDOUS TO YOUR HEALTH. INHALING ASBESTOS HAS BEEN LINKED WITH VARIOUS TYPES OF CANCERS. IF YOU SMOKE AND INHALE ASBESTOS FIBERS, YOUR CHANCES OF DEVELOPING LUNG CANCER IS GREATER THAN THAT OF THE NONSMOKING PUBLIC.

Your employer's contract with the owner for the above project requires that: You must be supplied with the proper personal protective equipment including an adequate respirator and be trained in its use. You must be trained in safe and healthy work practices and in the use of the equipment found at an asbestos abatement project. You must receive/have a current medical examination for working with asbestos. These things shall be provided at no cost to you. By signing this certificate you are indicating to the owner that your employer has met these obligations.

RESPIRATORY PROTECTION: I have been trained in the proper use of respirators and have been informed of the type of respirator to be used on the above indicated project. I have a copy of the written Respiratory Protection Program issued by my employer. I have been provided for my exclusive use, at no cost, with a respirator to be used on the above indicated project.

TRAINING COURSE: I have been trained by a third party, State/EPA accredited trainer in the requirements for an AHERA/OSHA Asbestos Abatement Worker training course, 32 hours minimum duration. I currently have a valid State accreditation certificate. The topics covered in the course include, as a minimum, the following:

- Physical Characteristics and Background Information on Asbestos
- Potential Health Effects Related to Exposure to Asbestos
- Employee Personal Protective Equipment
- Establishment of a Respiratory Protection Program
- State of the Art Work Practices
- Personal Hygiene
- Additional Safety Hazards
- Medical Monitoring
- Air Monitoring
- Relevant Federal, State and Local Regulatory Requirements, Procedures, and Standards
- Asbestos Waste Disposal

MEDICAL EXAMINATION: I have had a medical examination within the past 12 months which was paid for by my employer. This examination included: health history, occupational history, pulmonary function test, and may have included a chest x-ray evaluation. The physician issued a positive written opinion after the examination.

Signature: _____

Printed Name: _____

Social Security Number: _____

Witness: _____

ATTACHMENT #3

AFFIDAVIT OF MEDICAL SURVEILLANCE, RESPIRATORY PROTECTION AND TRAINING/ACCREDITATION

VA PROJECT NAME AND NUMBER: _____

VA MEDICAL FACILITY: _____

ABATEMENT CONTRACTOR'S NAME AND ADDRESS: _____

1. I verify that the following individual

Name: _____ Social Security Number: _____

who is proposed to be employed in asbestos abatement work associated with the above project by the named Abatement Contractor, is included in a medical surveillance program in accordance with 29 CFR 1926.1101(m), and that complete records of the medical surveillance program as required by 29 CFR 1926.1101(m)(n) and 29 CFR 1910.20 are kept at the offices of the Abatement Contractor at the following address.

Address: _____

2. I verify that this individual has been trained, fit-tested and instructed in the use of all appropriate respiratory protection systems and that the person is capable of working in safe and healthy manner as expected and required in the expected work environment of this project.

3. I verify that this individual has been trained as required by 29 CFR 1926.1101(k). This individual has also obtained a valid State accreditation certificate. Documentation will be kept on-site.

4. I verify that I meet the minimum qualifications criteria of the VA specifications for a CPIH.

Signature of CPIH/CIH: _____ Date: _____

Printed Name of CPIH/CIH: _____

Signature of Contractor: _____ Date: _____

Printed Name of Contractor: _____

ATTACHMENT #4

ABATEMENT CONTRACTOR/COMPETENT PERSON(S) REVIEW AND ACCEPTANCE OF THE VA'S ASBESTOS SPECIFICATIONS

VA Project Location: _____

VA Project #: _____

VA Project Description: _____

This form shall be signed by the Asbestos Abatement Contractor Owner and the Asbestos Abatement Contractor's Competent Person(s) prior to any start of work at the VA related to this Specification. If the Asbestos Abatement Contractor's/Competent Person(s) has not signed this form, they shall not be allowed to work on-site.

I, the undersigned, have read VA's Asbestos Specification regarding the asbestos abatement requirements. I understand the requirements of the VA's Asbestos Specification and agree to follow these requirements as well as all required rules and regulations of OSHA/EPA/DOT and State/Local requirements. I have been given ample opportunity to read the VA's Asbestos Specification and have been given an opportunity to ask any questions regarding the content and have received a response related to those questions. I do not have any further questions regarding the content, intent and requirements of the VA's Asbestos Specification.

At the conclusion of the asbestos abatement, I will certify that all asbestos abatement work was done in accordance with the VA's Asbestos Specification and all ACM was removed properly and no fibrous residue remains on any abated surfaces.

Abatement Contractor Owner's Signature _____ Date _____

Abatement Contractor Competent Person(s) _____ Date _____

- - - END- - - -

THIS PAGE INTENTIONALLY LEFT BLANK

SECTION 03 30 00
CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.1 DESCRIPTION:

This section specifies cast-in-place structural concrete and materials and mixes for other concrete.

1.2 RELATED WORK:

- A. Materials testing and inspection during construction: Section 01 45 29, TESTING LABORATORY SERVICES.
- B. Concrete roads, walks, and similar exterior site work: Section 32 05 23, CEMENT AND CONCRETE FOR EXTERIOR IMPROVEMENTS.

1.3 TESTING AGENCY FOR CONCRETE MIX DESIGN:

- A. Testing agency retained and reimbursed by the Contractor and approved by Resident Engineer.
- B. Testing agency maintaining active participation in Program of Cement and Concrete Reference Laboratory (CCRL) of National Institute of Standards and Technology. Accompany request for approval of testing agency with a copy of Report of Latest Inspection of Laboratory Facilities by CCRL.
- C. Testing agency shall furnish equipment and qualified technicians to establish proportions of ingredients for concrete mixes.

1.4 TOLERANCES:

- A. Formwork: ACI 117, except the elevation tolerance of formed surfaces before removal of shores is +0 mm (+0 inch) and -20 mm (-3/4 inch).
- B. Reinforcement Fabricating and Placing: ACI 117, except that fabrication tolerance for bar sizes Nos. 10, 13, and 16 (Nos. 3, 4, and 5) (Tolerance Symbol 1 in Fig. 2.1(a), ACI, 117) used as column ties or stirrups is +0 mm (+0 inch) and -13 mm (-1/2 inch) where gross bar length is less than 3600 mm (12 feet), or +0 mm (+0 inch) and -20 mm (3/4 inch) where gross bar length is 3600 mm (12 feet) or more.
- C. Cross-Sectional Dimension: ACI 117, except tolerance for thickness of slabs 12 inches or less is +20 mm (+3/4 inch) and - 6 mm (-1/4 inch). Tolerance of thickness of beams more than 300 mm (12 inch) but less than 900 mm (3 feet) is +20 mm (+3/4 inch) and -10 mm (-3/8 inch).
- D. Slab Finishes: ACI 117, Section 4.5.6, F-number method in accordance with ASTM E1155, except as follows:
 - 1. Test entire slab surface, including those areas within 600 mm (2 feet) of construction joints and vertical elements that project through slab surface.

2. Maximum elevation change which may occur within 600 mm (2 feet) of any column or wall element is 6 mm (0.25 inches).
3. Allow sample measurement lines that are perpendicular to construction joints to extend past joint into previous placement no further than 1500 mm (5 feet). 1.5

REGULATORY REQUIREMENTS:

- A. ACI SP-66 - ACI Detailing Manual.
- B. ACI 318 - Building Code Requirements for Reinforced Concrete.
- C. ACI 301 - Standard Specifications for Structural

Concrete. **1.6 SUBMITTALS:**

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, and SAMPLES.
- B. Shop Drawings: Reinforcing steel: Complete shop drawings
- D. Manufacturer's Certificates:
 1. Abrasive aggregate.
 2. Lightweight aggregate for structural concrete.
 3. Air-entraining admixture.
 4. Chemical admixtures, including chloride ion content.
 5. Waterproof paper for curing concrete.
 6. Liquid membrane-forming compounds for curing concrete.
 7. Non-shrinking grout.
 8. Liquid hardener.
 9. Waterstops.
 10. Expansion joint filler.
 11. Adhesive binder.
- F. Test Report for Concrete Mix Designs: Trial mixes including water-cement fly ash, ratio curves, concrete mix ingredients, and admixtures.

1.7 DELIVERY, STORAGE, AND HANDLING:

- A. Conform to ACI 304. Store aggregate separately for each kind or grade, to prevent segregation of sizes and avoid inclusion of dirt and other materials.
- B. Deliver cement in original sealed containers bearing name of brand and manufacturer, and marked with net weight of contents. Store in suitable watertight building in which floor is raised at least 300 mm (1 foot) above ground. Store bulk cement and fly ash in separate suitable bins.
- C. Deliver other packaged materials for use in concrete in original sealed containers, plainly marked with manufacturer's name and brand, and protect from damage until used.

1.8 PRE-CONCRETE CONFERENCE:

- A. General: At least 15 days prior to submittal of design mixes, conduct a meeting to review proposed methods of concrete construction to achieve the required results.
- B. Agenda: Includes but is not limited to:
 - 1. Submittals.
 - 2. Coordination of work.
 - 3. Availability of material.
 - 4. Concrete mix design including admixtures.
 - 5. Methods of placing, finishing, and curing.
 - 6. Finish criteria required to obtain required flatness and levelness.
 - 7. Timing of floor finish measurements.
 - 8. Material inspection and testing.
- C. Attendees: Include but not limited to representatives of Contractor; subcontractors involved in supplying, conveying, placing, finishing, and curing concrete; lightweight aggregate manufacturer; admixture manufacturers; Resident Engineer; Consulting Engineer; Department of Veterans Affairs retained testing laboratories for concrete testing and finish (F-number) verification.
- D. Minutes of the meeting: Contractor shall take minutes and type and distribute the minutes to attendees within five days of the meeting.

1.10 APPLICABLE PUBLICATIONS:

- A. Publications listed below form a part of this specification to extent referenced. Publications are referenced in text by basic designation only.
- B. American Concrete Institute (ACI):
 - 117-10 Tolerances for Concrete Construction and Materials
 - 211.1-91(R2009) Selecting Proportions for Normal, Heavyweight, and Mass Concrete
 - 211.2-98(R2004) Selecting Proportions for Structural Lightweight Concrete
 - 214R-02Evaluation of Strength Test Results of Concrete
 - 301-10Structural Concrete
 - 304R-00(R2009)Guide for Measuring, Mixing, Transporting, and Placing Concrete
 - 305R-10Hot Weather Concreting
 - 306R-10Cold Weather Concreting

- 308R-01(R2008) Standard Practice for Curing Concrete
- 309R-05 Guide for Consolidation of Concrete
- 318-08 Building Code Requirements for Reinforced
Concrete and Commentary
- 347-04 Guide to Formwork for Concrete
- SP-66-04 ACI Detailing Manual
- C. American National Standards Institute and American Hardboard Association
(ANSI/AHA):
- A135.4-2004 Basic Hardboard
- D. American Society for Testing and Materials (ASTM):
- A82/A82M-07 Steel Wire, Plain, for Concrete Reinforcement
- A185/185M-07 Steel Welded Wire Fabric, Plain, for Concrete
Reinforcement
- A615/A615M-09 Deformed and Plain Billet-Steel Bars for
Concrete Reinforcement
- A653/A653M-09 Steel Sheet, Zinc-Coated (Galvanized) or Zinc-
Iron Alloy-Coated (Galvannealed) by the Hot-Dip
Process
- A706/A706M-09 Low-Alloy Steel Deformed and Plain Bars for
Concrete Reinforcement
- A767/A767M-09 Zinc-Coated (Galvanized) Steel Bars for Concrete
Reinforcement
- A775/A775M-07 Epoxy-Coated Reinforcing Steel Bars
- A820-06 Steel Fibers for Fiber-Reinforced Concrete
- A996/A996M-09 Rail-Steel and Axle-Steel Deformed Bars for
Concrete Reinforcement
- C31/C31M-09 Making and Curing Concrete Test Specimens in the
field
- C33-08 Concrete Aggregates
- C39/C39M-09 Compressive Strength of Cylindrical Concrete
Specimens
- C94/C94M-09 Ready-Mixed Concrete
- C143/C143M-10 Slump of Hydraulic Cement Concrete
- C150-09 Portland Cement
- C171-07 Sheet Materials for Curing Concrete
- C172-08 Sampling Freshly Mixed Concrete
- C173-10 Air Content of Freshly Mixed Concrete by the
Volumetric Method

- C192/C192M-07 Making and Curing Concrete Test Specimens in the Laboratory
- C231-09 Air Content of Freshly Mixed Concrete by the Pressure Method
- C260-06 Air-Entraining Admixtures for Concrete
- C309-07 Liquid Membrane-Forming Compounds for Curing Concrete
- C330-09 Lightweight Aggregates for Structural Concrete
- C494/C494M-10 Chemical Admixtures for Concrete
- C618-08 Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use as a Mineral Admixture in Concrete
- C666/C666M-03 Resistance of Concrete to Rapid Freezing and Thawing
- C881/C881M-02 Epoxy-Resin-Base Bonding Systems for Concrete
- C1107/1107M-08 Packaged Dry, Hydraulic-Cement Grout (Non-shrink)
- C1315-08 Liquid Membrane-Forming Compounds Having Special Properties for Curing and Sealing Concrete
- D6-95(R2006) Loss on Heating of Oil and Asphaltic Compounds
- D297-93(R2006) Rubber Products-Chemical Analysis
- D1751-04(R2008) Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Non-extruding and Resilient Bituminous Types)
- D4397-09 Polyethylene Sheeting for Construction, Industrial and Agricultural Applications
- E1155-96(R2008) Determining F_F Floor Flatness and F_L Floor Levelness Numbers
- E. American Welding Society (AWS):
- D1.4/D1.4M-11 Structural Welding Code - Reinforcing Steel
- F. Concrete Reinforcing Steel Institute
(CRSI): Handbook 2008
- G. National Cooperative Highway Research Program (NCHRP):
Report On Concrete Sealers for the Protection of Bridge Structures

- H. U. S. Department of Commerce Product Standard (PS):
 PS 1Construction and Industrial Plywood
 PS 20American Softwood Lumber
- I. U. S. Army Corps of Engineers Handbook for Concrete and Cement:
 CRD C513Rubber Waterstops
 CRD C572Polyvinyl Chloride Waterstops

PART 2 - PRODUCTS:

2.1 FORMS:

- A. Wood: PS 20 free from loose knots and suitable to facilitate finishing concrete surface specified; tongue and grooved.
- B. Plywood: PS-1 Exterior Grade B-B (concrete-form) 16 mm (5/8 inch), or 20 mm (3/4 inch) thick for unlined contact form. B-B High Density Concrete Form Overlay optional.
- C. Metal for Concrete Rib-Type Construction: Steel (removal type) of suitable weight and form to provide required rigidity.
- D. Permanent Steel Form for Concrete Slabs: Corrugated, ASTM A653, Grade E, and Galvanized, ASTM A653, G90. Provide venting where insulating concrete fill is used.
- E. Corrugated Fiberboard Void Boxes: Double faced, completely impregnated with paraffin and laminated with moisture resistant adhesive, size as shown. Design forms to support not less than 48 KPa (1000 psf) and not lose more than 15 percent of their original strength after being completely submerged in water for 24 hours and then air dried.
- F. Form Lining:
1. Hardboard: ANSI/AHA A135.4, Class 2 with one (S1S) smooth side)
 2. Plywood: Grade B-B Exterior (concrete-form) not less than 6 mm (1/4 inch) thick.
 3. Plastic, fiberglass, or elastomeric capable of reproducing the desired pattern or texture.
- G. Form Ties: Develop a minimum working strength of 13.35 kN (3000 pounds) when fully assembled. Ties shall be adjustable in length to permit tightening of forms and not have any lugs, cones, washers to act as spreader within form, nor leave a hole larger than 20 mm (3/4 inch) diameter, or a depression in exposed concrete surface, or leave metal closer than 40 mm (1 1/2 inches) to concrete surface. Wire ties not permitted. Cutting ties back from concrete face not permitted.

2.2 MATERIALS:

- A. Portland Cement: ASTM C150 Type I or II.
- B. Fly Ash: ASTM C618, Class C or F including supplementary optional requirements relating to reactive aggregates and alkalies, and loss on ignition (LOI) not to exceed 5 percent.
- C. Coarse Aggregate: ASTM C33.
 - 1. Size 67 or Size 467 may be used for footings and walls over 300 mm (12 inches) thick.
 - 2. Coarse aggregate for applied topping, encasement of steel columns, and metal pan stair fill shall be Size 7.
 - 3. Maximum size of coarse aggregates not more than one-fifth of narrowest dimension between sides of forms, one-third of depth of slabs, nor three-fourth of minimum clear spacing between reinforcing bars.
- D. Lightweight Aggregates for Structural Concrete: ASTM C330, Table 1. Maximum size of aggregate not larger than one-fifth of narrowest dimension between forms, nor three-fourth of minimum clear distance between reinforcing bars. Contractor to furnish certified report to verify that aggregate is sound and durable, and has a durability factor of not less than 80 based on 300 cycles of freezing and thawing when tested in accordance with ASTM C666.
- E. Fine Aggregate: ASTM C33. Fine aggregate for applied concrete floor topping shall pass a 4.75 mm (No. 4) sieve, 10 percent maximum shall pass a 150 μ m (No. 100) sieve.
- F. Mixing Water: Fresh, clean, and potable.
- G. Admixtures:
 - 1. Water Reducing Admixture: ASTM C494, Type A and not contain more chloride ions than are present in municipal drinking water.
 - 2. Water Reducing, Retarding Admixture: ASTM C494, Type D and not contain more chloride ions than are present in municipal drinking water.
 - 3. High-Range Water-Reducing Admixture (Superplasticizer): ASTM C494, Type F or G, and not contain more chloride ions than are present in municipal drinking water.
 - 4. Non-Corrosive, Non-Chloride Accelerator: ASTM C494, Type C or E, and not contain more chloride ions than are present in municipal drinking water. Admixture manufacturer must have long-term non-corrosive test data from an independent testing laboratory of at least one year

- duration using an acceptable accelerated corrosion test method such as that using electrical potential measures.
5. Air Entraining Admixture: ASTM C260.
 6. Prohibited Admixtures: Calcium chloride, thiocyanate or admixtures containing more than 0.05 percent chloride ions are not permitted.
 7. Certification: Written conformance to the requirements above and the chloride ion content of the admixture prior to mix design review.
- H. Vapor Barrier: ASTM D4397, 0.25 mm (10 mil).
- I. Reinforcing Steel: ASTM A615, or ASTM A996, deformed, grade as shown.
- J. Welded Wire Reinforcing: ASTM A185.
- K. Reinforcing Bars to be Welded: ASTM A706.
- L. Cold Drawn Steel Wire: ASTM A82.
- M. Reinforcement for Metal Pan Stair Fill: 50 mm (2 inch) wire mesh, either hexagonal mesh at .8Kg/m² (1.5 pounds per square yard), or square mesh at .6Kg/m² (1.17 pounds per square yard).
- N. Supports, Spacers, and Chairs: Types which will hold reinforcement in position shown in accordance with requirements of ACI 318 except as specified.
- O. Expansion Joint Filler: ASTM D1751.
- P. Sheet Materials for Curing Concrete: ASTM C171.
- Q. Liquid Membrane-forming Compounds for Curing Concrete: ASTM C309, Type I, with fugitive dye. Compound shall be compatible with scheduled surface treatment, such as paint and resilient tile, and shall not discolor concrete surface.
- R. Abrasive Aggregate: Aluminum oxide grains or emery grits.
- S. Moisture Vapor Emissions & Alkalinity Control Sealer: 100% active colorless aqueous silicate solution concrete surface treatment applied the day of the concrete pour in lieu of other curing methods for all concrete slabs receiving resilient flooring, such as, sheet vinyl, vinyl composition tile, rubber, wood flooring, carpet, epoxy coatings and overlays .
1. ASTM C1315 Type 1 Class A, and ASTM C309 Type 1 Class A, penetrating product to have no less than 34% solid content, leaving no sheen, volatile organic compound (VOC) content rating as required to suite regulatory requirements. The product shall have at least a five (5) year documented history in controlling moisture vapor emission from damaging floor covering, compatible with all finish materials.

2. MVE 15-Year Warranty:
 - a. When a floor covering is installed on a below grade, on grade, or above grade concrete slab treated with Moisture Vapor Emissions & Alkalinity Control Sealer according to manufacturer's instruction, sealer manufacturer shall warrant the floor covering system against failure due to moisture vapor migration or moisture-born contaminates for a period of fifteen (15) years from the date of original installation. The warranty shall cover all labor and materials needed to replace all floor covering that fails due to moisture vapor emission & moisture born contaminates.
- T. Penetrating Sealer: For use on parking garage ramps and decks. High penetration silane sealer providing minimum 95 percent screening per National Cooperative Highway Research Program (NCHRP) No. 244 standards for chloride ion penetration resistance. Requires moist (non-membrane) curing of slab.
- U. Non-Shrink Grout:
 1. ASTM C1107, pre-mixed, produce a compressive strength of at least 18 MPa (2500 psi) at three days and 35 MPa (5000 psi) at 28 days. Furnish test data from an independent laboratory indicating that the grout when placed at a fluid consistency shall achieve 95 percent bearing under a 1200 mm x 1200 mm (4 foot by 4 foot) base plate.
 2. Where high fluidity or increased placing time is required, furnish test data from an independent laboratory indicating that the grout when placed at a fluid consistency shall achieve 95 percent under an 450 mm x 900 mm (18 inch by 36 inch) base plate.
- V. Adhesive Binder: ASTM C881.
 1. Polyvinyl Chloride Waterstop: CRD C572.
 2. Rubber Waterstops: CRD C513.
 3. Bentonite Water Stop: Flexible strip of bentonite 25 mm x 20 mm (1 inch by 3/4 inch), weighing 8.7 kg/m (5.85 lbs. per foot) composed of Butyl Rubber Hydrocarbon (ASTM D297), Bentonite (SS-S-210-A) and Volatile Matter (ASTM D6).
 4. Porous Backfill: Crushed stone or gravel graded from 25 mm to 20 mm (1 inch to 3/4 inch).
 5. Synthetic Fibers: Monofilament or fibrillated polypropylene fibers for secondary reinforcing of concrete members. Use appropriate length and 0.9 kg/m³ (1.5 lb. per cubic yard). Product shall have a UL rating.

6. Steel Fibers: ASTM A820, Type I cold drawn, high tensile steel wire for use as primary reinforcing in slab-on-grade. Minimum dosage rate 18 kg/m³ (30 lb. per cubic yard).
7. Epoxy Joint Filler: Two component, 100 percent solids compound, with a minimum shore D hardness of 50.
8. Bonding Admixture: Non-rewettable, polymer modified, bonding compound.
9. Architectural Concrete: For areas designated as architectural concrete on the Contract Documents, use colored cements and specially selected aggregates as necessary to produce a concrete of a color and finish which exactly matches the designated sample panel.

2.3 CONCRETE MIXES:

- A. Mix Designs: Proportioned in accordance with Section 5.3, "Proportioning on the Basis of Field Experience and/or Trial Mixtures" of ACI 318.
 1. If trial mixes are used, make a set of at least 6 cylinders in accordance with ASTM C192 for test purposes from each trial mix; test three for compressive strength at 7 days and three at 28 days.
 2. Submit a report of results of each test series, include a detailed listing of the proportions of trial mix or mixes, including cement, fly ash, admixtures, weight of fine and coarse aggregate per m³ (cubic yard) measured dry rodded and damp loose, specific gravity, fineness modulus, percentage of moisture, air content, water-cement -fly ash ratio, and consistency of each cylinder in terms of slump. Include dry unit weight of lightweight structural concrete.
 3. Prepare a curve showing relationship between water-cement -fly ash ratio at 7-day and 28-day compressive strengths. Plot each curve using at least three specimens.
 4. If the field experience method is used, submit complete standard deviation analysis.
- B. Fly Ash Testing: Submit certificate verifying conformance with specifications initially with mix design and for each truck load of fly ash delivered from source. Notify Resident Engineer immediately when change in source is anticipated. Prior to beginning trial mixes submit to the Resident Engineer the following representative samples of material to be used, properly identified source and project description and number, type of testing (complete chemical and physical), suitably packaged for shipment, and addressed as specified. Allow 60 calendar days for test results after submittal of sample.

1. Fly ash - 2.25 kg (five pounds).
2. Portland cement - 3.5 kg (8 pounds):
 - a. Address -Waterways Experiment Station (WES)
 - b. 3909 Halls Ferry Road
 - c. Vicksburg, MS 39180-6199
 - d. ATTN: Engineering Materials Group
- C. After approval of mixes no substitution in material or change in proportions of approval mixes may be made without additional tests and approval of Resident Engineer or as specified. Making and testing of preliminary test cylinders may be carried on pending approval of cement and fly ash, providing Contractor and manufacturer certify that ingredients used in making test cylinders are the same. Resident Engineer may allow Contractor to proceed with depositing concrete for certain portions of work, pending final approval of cement and fly ash and approval of design mix.
- D. Cement Factor: Maintain minimum cement factors in Table I regardless of compressive strength developed above minimums. Use Fly Ash as an admixture with 20% replacement by weight in all structural work.

TABLE I - CEMENT AND WATER FACTORS FOR CONCRETE

Concrete Strength		Non-Air-Entrained		Air-Entrained	
Min. 28 Day Comp. Str. (psi)	Min. Cement kg/m ³ (lbs/c. yd)	Max. Water Cement Ratio	Min. Cement kg/m ³ (lbs/c. yd)	Max. Water Cement Ratio	
35 (5000) ^{1,3}	375 (630)	0.45	385 (650)	0.40	
30 (4000) ^{1,3}	325 (550)	0.55	340 (570)	0.50	
30 (4000) ^{1,3}	280 (470)	0.65	290 (490)	0.55	
30 (4000) ^{1,3}	300 (500)	*	310 (520)	*	

1. If trial mixes are used, the proposed mix design shall achieve a compressive strength 8.3 MPa (1200 psi) in excess of f'c. For concrete strengths above 35 Mpa (5000 psi), the proposed mix design shall achieve a compressive strength 9.7 MPa (1400 psi) in excess of f'c.
2. Lightweight Structural Concrete. Pump mixes may require higher cement values.
3. For concrete exposed to high sulfate content soils maximum water cement ratio is 0.44.
4. Determined by Laboratory in accordance with ACI 211.1 for normal concrete or ACI 211.2 for lightweight structural concrete.

- E. Maximum Slump: Maximum slump, as determined by ASTM C143 with tolerances as established by ASTM C94, for concrete to be vibrated shall be as shown in Table II.

TABLE II - MAXIMUM SLUMP, MM (INCHES)*

Type of Construction	Normal Weight Concrete	Lightweight Structural Concrete
Reinforced Footings and Substructure Walls	75mm (3 inches)	75 mm (3 inches)
Slabs, Beams, Reinforced Walls, and Building Columns	100 mm (4 inches)	100 mm (4 inches)

- F. Slump may be increased by the use of the approved high-range water-reducing admixture (superplasticizer). Tolerances as established by ASTM C94. Concrete containing the high-range-water-reducing admixture may have a maximum slump of 225 mm (9 inches). The concrete shall arrive at the job site at a slump of 50 mm to 75 mm (2 inches to 3 inches), and 75 mm to 100 mm (3 inches to 4 inches) for lightweight concrete. This should be verified, and then the high-range-water-reducing admixture added to increase the slump to the approved level.
- G. Air-Entrainment: Air-entrainment of normal weight concrete shall conform with Table III. Air-entrainment of lightweight structural concrete shall conform with Table IV. Determine air content by either ASTM C173 or ASTM C231.

TABLE III - TOTAL AIR CONTENT FOR VARIOUS SIZES OF COARSE AGGREGATES (NORMAL CONCRETE)

Nominal Maximum Size of Total Air Content	Coarse Aggregate, mm (Inches) Percentage by Volume
10 mm (3/8 in).6 to 10	13 mm (1/2 in).5 to 9
20 mm (3/4 in).4 to 8	25 mm (1 in).3-1/2 to 6-1/2
40 mm (1 1/2 in).3 to 6	

TABLE IV
AIR CONTENT OF LIGHTWEIGHT STRUCTURAL CONCRETE

Nominal Maximum size of Total Air Content	Coarse Aggregate, mm's (Inches) Percentage by Volume
Greater than 10 mm (3/8 in) 4 to 8	10 mm (3/8 in) or less 5 to 9

- H. High early strength concrete, made with Type III cement or Type I cement plus non-corrosive accelerator, shall have a 7-day compressive strength equal to specified minimum 28-day compressive strength for concrete type specified made with standard Portland cement.

- I. Lightweight structural concrete shall not weigh more than air-dry unit weight shown. Air-dry unit weight determined on 150 mm by 300 mm (6 inch by 12 inch) test cylinders after seven days standard moist curing followed by 21 days drying at 23 degrees C \pm 1.7 degrees C (73.4 \pm 3 degrees Fahrenheit), and 50 (plus or minus 7) percent relative humidity. Use wet unit weight of fresh concrete as basis of control in field.
- J. Concrete slabs placed at air temperatures below 10 degrees C (50 degrees Fahrenheit) use non-corrosive, non-chloride accelerator. Concrete required to be air entrained use approved air entraining admixture. Pumped concrete, synthetic fiber concrete, architectural concrete, concrete required to be watertight, and concrete with a water/cement ratio below 0.50 use high-range water-reducing admixture (superplasticizer).
- K. Durability: Use air entrainment for exterior exposed concrete subjected to freezing and thawing and other concrete shown or specified. Air content as shown in Table III or Table IV.
- L. Enforcing Strength Requirements: Test as specified in Section 01 45 29, TESTING LABORATORY SERVICES, during the progress of the work. Seven-day tests may be used as indicators of 28-day strength. Average of any three 28-day consecutive strength tests of laboratory-cured specimens representing each type of concrete shall be equal to or greater than specified strength. No single test shall be more than 3.5 MPa (500 psi) below specified strength. Interpret field test results in accordance with ACI 214. Should strengths shown by test specimens fall below required values, Resident Engineer may require any one or any combination of the following corrective actions, at no additional cost to the Government:
1. Require changes in mix proportions by selecting one of the other appropriate trial mixes or changing proportions, including cement content, of approved trial mix.
 2. Require additional curing and protection.
 3. If five consecutive tests fall below 95 percent of minimum values given in Table I or if test results are so low as to raise a question as to the safety of the structure, Resident Engineer may direct Contractor to take cores from portions of the structure. Use results from cores tested by the Contractor retained testing agency to analyze structure.

4. If strength of core drilled specimens falls below 85 percent of minimum value given in Table I, Resident Engineer may order load tests, made by Contractor retained testing agency, on portions of building so affected. Load tests in accordance with ACI 318 and criteria of acceptability of concrete under test as given therein.
5. Concrete work, judged inadequate by structural analysis, by results of load test, or for any reason, shall be reinforced with additional construction or replaced, if directed by the Resident Engineer.
- 2.4 BATCHING AND MIXING:**

- A. General: Concrete shall be "Ready-Mixed" and comply with ACI 318 and ASTM C94, except as specified. Batch mixing at the site is permitted. Mixing process and equipment must be approved by Resident Engineer. With each batch of concrete, furnish certified delivery tickets listing information in Paragraph 16.1 and 16.2 of ASTM C94. Maximum delivery temperature of concrete is 38⁰C (100 degrees Fahrenheit). Minimum delivery temperature as follows:

Atmospheric Temperature	Minimum Concrete Temperature
-1. degrees to 4.4 degrees C (30 degrees to 40 degrees F)	15.6 degrees C (60 degrees F.)
-17 degrees C to -1.1 degrees C (0 degrees to 30 degrees F.)	21 degrees C (70 degrees F.)

1. Services of aggregate manufacturer's representative shall be furnished during the design of trial mixes and as requested by the Resident Engineer for consultation during batching, mixing, and placing operations of lightweight structural concrete. Services will be required until field controls indicate that concrete of required quality is being furnished. Representative shall be thoroughly familiar with the structural lightweight aggregate, adjustment and control of mixes to produce concrete of required quality. Representative shall assist and advise Resident Engineer.

PART 3 - EXECUTION**3.1 FORMWORK:**

- A. General: Design in accordance with ACI 347 is the responsibility of the Contractor. The Contractor shall retain a registered Professional Engineer to design the formwork, shores, and reshores.
 - 1. Form boards and plywood forms may be reused for contact surfaces of exposed concrete only if thoroughly cleaned, patched, and repaired and Resident Engineer approves their reuse.
 - 2. Provide forms for concrete footings unless Resident Engineer determines forms are not necessary.
 - 3. Corrugated fiberboard forms: Place forms on a smooth firm bed, set tight, with no buckled cartons to prevent horizontal displacement, and in a dry condition when concrete is placed.
- B. Treating and Wetting: Treat or wet contact forms as follows:
 - 1. Coat plywood and board forms with non-staining form sealer. In hot weather, cool forms by wetting with cool water just before concrete is placed.
 - 2. Clean and coat removable metal forms with light form oil before reinforcement is placed. In hot weather, cool metal forms by thoroughly wetting with water just before placing concrete.
 - 3. Use sealer on reused plywood forms as specified for new material.
- C. Size and Spacing of Studs: Size and space studs, wales and other framing members for wall forms so as not to exceed safe working stress of kind of lumber used nor to develop deflection greater than 1/270 of free span of member.
- D. Unlined Forms: Use plywood forms to obtain a smooth finish for concrete surfaces. Tightly butt edges of sheets to prevent leakage. Back up all vertical joints solidly and nail edges of adjacent sheets to same stud with 6d box nails spaced not over 150 mm (6 inches) apart.
- E. Lined Forms: May be used in lieu of unlined plywood forms. Back up form lining solidly with square edge board lumber securely nailed to studs with all edges in close contact to prevent bulging of lining. No joints in lining and backing may coincide. Nail abutted edges of sheets to same backing board. Nail lining at not over 200 mm (8 inches) on center along edges and with at least one nail to each square foot of surface area; nails to be 3d blued shingle or similar nails with thin flatheads.
- F. Architectural Liner: Attach liner as recommended by the manufacturer with tight joints to prevent leakage.

- G. Wall Form Ties: Locate wall form ties in symmetrically level horizontal rows at each line of wales and in plumb vertical tiers. Space ties to maintain true, plumb surfaces. Provide one row of ties within 150 mm (6 inches) above each construction joint. Space through-ties adjacent to horizontal and vertical construction joints not over 450 mm (18 inches) on center.
1. Tighten row of ties at bottom of form just before placing concrete and, if necessary, during placing of concrete to prevent seepage of concrete and to obtain a clean line. Ties to be entirely removed shall be loosened 24 hours after concrete is placed and shall be pulled from least important face when removed.
 2. Coat surfaces of all metal that is to be removed with paraffin, cup grease or a suitable compound to facilitate removal.
- H. Inserts, Sleeves, and Similar Items: Flashing reglets, steel strips, masonry ties, anchors, wood blocks, nailing strips, grounds, inserts, wire hangers, sleeves, drains, guard angles, forms for floor hinge boxes, inserts or bond blocks for elevator guide rails and supports, and other items specified as furnished under this and other sections of specifications and required to be in their final position at time concrete is placed shall be properly located, accurately positioned, and built into construction, and maintained securely in place.
1. Locate inserts or hanger wires for furred and suspended ceilings only in bottom of concrete joists, or similar concrete member of overhead concrete joist construction.
 2. Install sleeves, inserts and similar items for mechanical services in accordance with drawings prepared specially for mechanical services. Contractor is responsible for accuracy and completeness of drawings and shall coordinate requirements for mechanical services and equipment.
 3. Do not install sleeves in beams, joists or columns except where shown or permitted by Resident Engineer. Install sleeves in beams, joists, or columns that are not shown, but are permitted by the Resident Engineer, and require no structural changes, at no additional cost to the Government.
 4. Minimum clear distance of embedded items such as conduit and pipe is at least three times diameter of conduit or pipe, except at stub-ups and other similar locations.
 5. Provide recesses and blockouts in floor slabs for door closers and other hardware as necessary in accordance with manufacturer's instructions.

I. Construction Tolerances:

1. Set and maintain concrete formwork to assure erection of completed work within tolerances specified and to accommodate installation of other rough and finish materials. Accomplish remedial work necessary for correcting excessive tolerances. Erected work that exceeds specified tolerance limits shall be remedied or removed and replaced, at no additional cost to the Government.
2. Permissible surface irregularities for various classes of materials are defined as "finishes" in specification sections covering individual materials. They are to be distinguished from tolerances specified which are applicable to surface irregularities of structural elements.

3.2 PLACING REINFORCEMENT:

- A. General: Details of concrete reinforcement in accordance with ACI 318 unless otherwise shown.
- B. Placing: Place reinforcement conforming to CRSI DA4, unless otherwise shown.
 1. Place reinforcing bars accurately and tie securely at intersections and splices with 1.6 mm (16 gauge) black annealed wire. Secure reinforcing bars against displacement during the placing of concrete by spacers, chairs, or other similar supports. Portions of supports, spacers, and chairs in contact with formwork shall be made of plastic in areas that will be exposed when building is occupied. Type, number, and spacing of supports conform to ACI 318. Where concrete slabs are placed on ground, use concrete blocks or other non-corrodible material of proper height, for support of reinforcement. Use of brick or stone supports will not be permitted.
 2. Lap welded wire fabric at least 1 1/2 mesh panels plus end extension of wires not less than 300 mm (12 inches) in structural slabs. Lap welded wire fabric at least 1/2 mesh panels plus end extension of wires not less than 150 mm (6 inches) in slabs on grade.
 3. Splice column steel at no points other than at footings and floor levels unless otherwise shown.
- C. Spacing: Minimum clear distances between parallel bars, except in columns and multiple layers of bars in beams shall be equal to nominal diameter of bars. Minimum clear spacing is 25 mm (1 inch) or 1-1/3 times maximum size of coarse aggregate.

- D. Splicing: Splices of reinforcement made only as required or shown or specified. Accomplish splicing as follows:
1. Lap splices: Do not use lap splices for bars larger than Number 36 (Number 11). Minimum lengths of lap as shown.
 2. Welded splices: Splicing by butt-welding of reinforcement permitted providing the weld develops in tension at least 125 percent of the yield strength (f_y) for the bars. Welding conform to the requirements of AWS D1.4. Welded reinforcing steel conform to the chemical analysis requirements of AWS D1.4.
 - a. Submit test reports indicating the chemical analysis to establish weldability of reinforcing steel.
 - b. Submit a field quality control procedure to insure proper inspection, materials and welding procedure for welded splices.
 - c. Department of Veterans Affairs retained testing agency shall test a minimum of three splices, for compliance, locations selected by Resident Engineer.
 3. Mechanical Splices: Develop in tension and compression at least 125 percent of the yield strength (f_y) of the bars. Stresses of transition splices between two reinforcing bar sizes based on area of smaller bar. Provide mechanical splices at locations indicated. Use approved exothermic, tapered threaded coupling, or swaged and threaded sleeve. Exposed threads and swaging in the field not permitted.
 - a. Initial qualification: In the presence of Resident Engineer, make three test mechanical splices of each bar size proposed to be spliced. Department of Veterans Affairs retained testing laboratory will perform load test.
 - b. During installation: Furnish, at no additional cost to the Government, one companion (sister) splice for every 50 splices for load testing. Department of Veterans Affairs retained testing laboratory will perform the load test.
- E. Bending: Bend bars cold, unless otherwise approved. Do not field bend bars partially embedded in concrete, except when approved by Resident Engineer.
- F. Cleaning: Metal reinforcement, at time concrete is placed, shall be free from loose flaky rust, mud, oil, or similar coatings that will reduce bond.
- G. Future Bonding: Protect exposed reinforcement bars intended for bonding with future work by wrapping with felt and coating felt with a bituminous compound unless otherwise shown.

3.3 VAPOR BARRIER:

- A. Except where membrane waterproofing is required, interior concrete slab on grade shall be placed on a continuous vapor barrier.
 - 1. Place 100 mm (4 inches) of fine granular fill over the vapor barrier to act as a blotter for concrete slab.
 - 2. Vapor barrier joints lapped 150 mm (6 inches) and sealed with compatible waterproof pressure-sensitive tape.
 - 3. Patch punctures and tears.

3.4 MOISTURE VAPOR EMISSIONS & ALKALINITY CONTROL SEALER:

- A. Sealer is applied on the day of the concrete pour or as as soon as harsh weather permits, prior to any other chemical treatments for concrete slabs either on grade, below grade or above grade receiving resilient flooring, such as, sheet vinyl, vinyl composition tile, rubber, wood flooring, carpet, epoxy coatings and overlays.
- B. Manufacturer's representative will be on the site the day of concrete pour to install or train its application and document. He shall return on every application thereafter to verify that proper procedures are followed.
 - 1. Apply Sealer to concrete slabs as soon as final finishing operations are complete and the concrete has hardened sufficiently to sustain floor traffic without damage.
 - 2. Spray apply Sealer at the rate of 20 m² (200 square feet) per gallon. Lightly broom product evenly over the substrate and product has completely penetrated the surface.
 - 3. If within two (2) hours after initial application areas are subjected to heavy rainfall and puddling occurs, reapply Sealer product to these areas as soon as weather condition permits.

3.5 CONSTRUCTION JOINTS:

- A. Unless otherwise shown, location of construction joints to limit individual placement shall not exceed 24,000 mm (80 feet) in any horizontal direction, except slabs on grade which shall have construction joints shown. Allow 48 hours to elapse between pouring adjacent sections unless this requirement is waived by Resident Engineer.
- B. Locate construction joints in suspended floors near the quarter-point of spans for slabs, beams or girders, unless a beam intersects a girder at center, in which case joint in girder shall be offset a distance equal to twice width of beam. Provide keys and inclined dowels as shown. Provide longitudinal keys as shown.

- C. Place concrete for columns slowly and in one operation between joints. Install joints in concrete columns at underside of deepest beam or girder framing into column.
- D. Allow 2 hours to elapse after column is cast before concrete of supported beam, girder or slab is placed. Place girders, beams, grade beams, column capitals, brackets, and haunches at the same time as slab unless otherwise shown.
- E. Install polyvinyl chloride or rubber water seals, as shown in accordance with manufacturer's instructions, to form continuous watertight seal.

3.6 EXPANSION JOINTS:

- A. Clean expansion joint surfaces before installing premolded filler and placing adjacent concrete.
- B. Install polyvinyl chloride or rubber water seals, as shown in accordance with manufacturer's instructions, to form continuous watertight seal.

3.7 PLACING CONCRETE:

- A. Preparation:
 - 1. Remove hardened concrete, wood chips, shavings and other debris from forms.
 - 2. Remove hardened concrete and foreign materials from interior surfaces of mixing and conveying equipment.
 - 3. Have forms and reinforcement inspected and approved by Resident Engineer before depositing concrete.
 - 4. Provide runways for wheeling equipment to convey concrete to point of deposit. Keep equipment on runways which are not supported by or bear on reinforcement. Provide similar runways for protection of vapor barrier on coarse fill.
- B. Bonding: Before depositing new concrete on or against concrete which has been set, thoroughly roughen and clean existing surfaces of laitance, foreign matter, and loose particles.
 - 1. Preparing surface for applied topping:
 - a. Remove laitance, mortar, oil, grease, paint, or other foreign material by sand blasting. Clean with vacuum type equipment to remove sand and other loose material.
 - b. Broom clean and keep base slab wet for at least four hours before topping is applied.
 - c. Use a thin coat of one part Portland cement, 1.5 parts fine sand, bonding admixture; and water at a 50: 50 ratio and mix to achieve the consistency of thick paint. Apply to a damp base slab by

scrubbing with a stiff fiber brush. New concrete shall be placed while the bonding grout is still tacky.

- C. Conveying Concrete: Convey concrete from mixer to final place of deposit by a method which will prevent segregation. Method of conveying concrete subject to approval of COTR.
- D. Placing: For special requirements see Paragraphs, HOT WEATHER and COLD WEATHER.
1. Do not place concrete when weather conditions prevent proper placement and consolidation, or when concrete has attained its initial set, or has contained its water or cement content more than 1 1/2 hours.
 2. Deposit concrete in forms as near as practicable in its final position. Prevent splashing of forms or reinforcement with concrete in advance of placing concrete.
 3. Do not drop concrete freely more than 3000 mm (10 feet) for concrete containing the high-range water-reducing admixture (superplasticizer) or 1500 mm (5 feet) for conventional concrete. Where greater drops are required, use a tremie or flexible spout (canvas elephant trunk), attached to a suitable hopper.
 4. Discharge contents of tremies or flexible spouts in horizontal layers not exceeding 500 mm (20 inches) in thickness, and space tremies such as to provide a minimum of lateral movement of concrete.
 5. Continuously place concrete until an entire unit between construction joints is placed. Rate and method of placing concrete shall be such that no concrete between construction joints will be deposited upon or against partly set concrete, after it's initial set has taken place, or after 45 minutes of elapsed time during concrete placement.
 6. On bottom of members with severe congestion of reinforcement, deposit 25 mm (1 inch) layer of flowing concrete containing the specified high-range water-reducing admixture (superplasticizer). Successive concrete lifts may be a continuation of this concrete or concrete with a conventional slump.
 7. Concrete on metal deck:
 - a. Concrete on metal deck shall be minimum thickness shown. Allow for deflection of steel beams and metal deck under the weight of wet concrete in calculating concrete quantities for slab.
 - 1) The Contractor shall become familiar with deflection characteristics of structural frame to include proper amount of additional concrete due to beam/deck deflection.

- E. Consolidation: Conform to ACI 309. Immediately after depositing, spade concrete next to forms, work around reinforcement and into angles of forms, tamp lightly by hand, and compact with mechanical vibrator applied directly into concrete at approximately 450 mm (18 inch) intervals. Mechanical vibrator shall be power driven, hand operated type with minimum frequency of 5000 cycles per minute having an intensity sufficient to cause flow or settlement of concrete into place. Vibrate concrete to produce thorough compaction, complete embedment of reinforcement and concrete of uniform and maximum density without segregation of mix. Do not transport concrete in forms by vibration.
1. Use of form vibration shall be approved only when concrete sections are too thin or too inaccessible for use of internal vibration.
 2. Carry on vibration continuously with placing of concrete. Do not insert vibrator into concrete that has begun to set.

3.8 HOT WEATHER:

Follow the recommendations of ACI 305 or as specified to prevent problems in the manufacturing, placing, and curing of concrete that can adversely affect the properties and serviceability of the hardened concrete. Methods proposed for cooling materials and arrangements for protecting concrete shall be made in advance of concrete placement and approved by Resident Engineer.

3.9 COLD WEATHER:

Follow the recommendations of ACI 306 or as specified to prevent freezing of concrete and to permit concrete to gain strength properly. Use only the specified non-corrosive, non-chloride accelerator. Do not use calcium chloride, thiocyanates or admixtures containing more than 0.05 percent chloride ions. Methods proposed for heating materials and arrangements for protecting concrete shall be made in advance of concrete placement and approved by Resident Engineer.

3.10 PROTECTION AND CURING:

- A. Conform to ACI 308: Initial curing shall immediately follow the finishing operation. Protect exposed surfaces of concrete from premature drying, wash by rain and running water, wind, mechanical injury, and excessively hot or cold temperatures. Keep concrete not covered with membrane or other curing material continuously wet for at least 7 days after placing, except wet curing period for high-early-strength concrete shall be not less than 3 days. Keep wood forms continuously wet to prevent moisture loss until forms are removed. Cure exposed concrete

surfaces as described below. Other curing methods may be used if approved by Resident Engineer.

1. Liquid curing and sealing compounds: Apply by power-driven spray or roller in accordance with the manufacturer's instructions. Apply immediately after finishing. Maximum coverage $10\text{m}^2/\text{L}$ (400 square feet per gallon) on steel troweled surfaces and $7.5\text{m}^2/\text{L}$ (300 square feet per gallon) on floated or broomed surfaces for the curing/sealing compound.
2. Plastic sheets: Apply as soon as concrete has hardened sufficiently to prevent surface damage. Utilize widest practical width sheet and overlap adjacent sheets 50 mm (2 inches). Tightly seal joints with tape.
3. Paper: Utilize widest practical width paper and overlap adjacent sheets 50 mm (2 inches). Tightly seal joints with sand, wood planks, pressure-sensitive tape, mastic or glue.

3.11 REMOVAL OF FORMS:

- A. Remove in a manner to assure complete safety of structure after the following conditions have been met.
 1. Where structure as a whole is supported on shores, forms for beams and girder sides, columns, and similar vertical structural members may be removed after 24 hours, provided concrete has hardened sufficiently to prevent surface damage and curing is continued without any lapse in time as specified for exposed surfaces.
 2. Take particular care in removing forms of architectural exposed concrete to insure surfaces are not marred or gouged, and that corners and arises are true, sharp and unbroken.
- B. Control Test: Use to determine if the concrete has attained sufficient strength and curing to permit removal of supporting forms. Cylinders required for control tests taken in accordance with ASTM C172, molded in accordance with ASTM C31, and tested in accordance with ASTM C39. Control cylinders cured and protected in the same manner as the structure they represent. Supporting forms or shoring not removed until strength of control test cylinders have attained at least 70 percent of minimum 28-day compressive strength specified. Exercise care to assure that newly unsupported portions of structure are not subjected to heavy construction or material loading.
- C. Reshoring: Reshoring is required if superimposed load plus dead load of the floor exceeds the capacity of the floor at the time of loading.

Reshoring accomplished in accordance with ACI 347 at no additional cost to the Government.

3.12 CONCRETE SURFACE PREPARATION:

- A. Metal Removal: Unnecessary metal items cut back flush with face of concrete members.
- B. Patching: Maintain curing and start patching as soon as forms are removed. Do not apply curing compounds to concrete surfaces requiring patching until patching is completed. Use cement mortar for patching of same composition as that used in concrete. Use white or gray Portland cement as necessary to obtain finish color matching surrounding concrete. Thoroughly clean areas to be patched. Cut out honeycombed or otherwise defective areas to solid concrete to a depth of not less than 25 mm (1 inch). Cut edge perpendicular to surface of concrete. Saturate with water area to be patched, and at least 150 mm (6 inches) surrounding before placing patching mortar. Give area to be patched a brush coat of cement grout followed immediately by patching mortar. Cement grout composed of one part Portland cement, 1.5 parts fine sand, bonding admixture, and water at a 50:50 ratio, mix to achieve consistency of thick paint. Mix patching mortar approximately 1 hour before placing and remix occasionally during this period without addition of water. Compact mortar into place and screed slightly higher than surrounding surface. After initial shrinkage has occurred, finish to match color and texture of adjoining surfaces. Cure patches as specified for other concrete. Fill form tie holes which extend entirely through walls from unexposed face by means of a pressure gun or other suitable device to force mortar through wall. Wipe excess mortar off exposed face with a cloth.
- C. Upon removal of forms, clean vertical concrete surface that is to receive bonded applied cementitious application with wire brushes or by sand blasting to remove unset material, laitance, and loose particles to expose aggregates to provide a clean, firm, granular surface for bond of applied finish.

3.13 CONCRETE FINISHES:

- A. Architectural Concrete Finish: Match mock-up panel to satisfaction of Architect and COTR.
- B. Vertical and Overhead Surface Finishes:
 1. Unfinished areas: Vertical and overhead concrete surfaces exposed in pipe basements, elevator and dumbwaiter shafts, pipe spaces, pipe

trenches, above suspended ceilings, manholes, and other unfinished areas will not require additional finishing.

2. Interior exposed areas finished: Give a grout finish of uniform color and smooth finish treated as follows:
 - a. After concrete has hardened and laitance, fins and burrs removed, scrub concrete with wire brushes. Clean stained concrete surfaces by use of a hone stone.
 - b. Apply grout composed of one part of Portland cement, one part fine sand, smaller than a 600 μm (No. 30) sieve. Work grout into surface of concrete with cork floats or fiber brushes until all pits, and honeycombs are filled.
 - c. After grout has hardened slightly, but while still plastic, scrape grout off with a sponge rubber float and, about 1 hour later, rub concrete vigorously with burlap to remove any excess grout remaining on surfaces.
 - d. In hot, dry weather use a fog spray to keep grout wet during setting period. Complete finish of area in same day. Make limits of finished areas at natural breaks in wall surface. Leave no grout on concrete surface overnight.

C. Slab Finishes:

1. Monitoring and Adjustment: Provide continuous cycle of placement, measurement, evaluation and adjustment of procedures to produce slabs within specified tolerances. Monitor elevations of structural steel in key locations before and after concrete placement to establish typical deflection patterns for the structural steel. Determine elevations of cast-in-place slab soffits prior to removal of shores. Provide information to COTR and floor consultant for evaluation and recommendations for subsequent placements.
2. Set perimeter forms to serve as screed using either optical or laser instruments. For slabs on grade, wet screeds may be used to establish initial grade during strike-off, unless COTR determines that the method is proving insufficient to meet required finish tolerances and directs use of rigid screed guides. Where wet screeds are allowed, they shall be placed using grade stakes set by optical or laser instruments. Use rigid screed guides, as opposed to wet screeds, to control strike-off elevation for all types of elevated (non slab-on-grade) slabs. Divide bays into halves or thirds by hard screeds. Adjust as necessary where monitoring of previous placements indicates unshored structural steel deflections to other than a level profile.

3. Place slabs monolithically. Once slab placement commences, complete finishing operations within same day. Slope finished slab to floor drains where they occur, whether shown or not.
4. Use straightedges specifically made for screeding, such as hollow magnesium straightedges or power strike-offs. Do not use pieces of dimensioned lumber. Strike off and screed slab to a true surface at required elevations. Use optical or laser instruments to check concrete finished surface grade after strike-off. Repeat strike-off as necessary. Complete screeding before any excess moisture or bleeding water is present on surface. Do not sprinkle dry cement on the surface.
5. Immediately following screeding, and before any bleed water appears, use a 3000 mm (10 foot) wide highway straightedge in a cutting and filling operation to achieve surface flatness. Do not use bull floats or darbys, except that darbying may be allowed for narrow slabs and restricted spaces.
6. Wait until water sheen disappears and surface stiffens before proceeding further. Do not perform subsequent operations until concrete will sustain foot pressure with maximum of 6 mm (1/4 inch) indentation.
7. Scratch Finish: Finish base slab to receive a bonded applied cementitious application as indicated above, except that bull floats and darbys may be used. Thoroughly coarse wire broom within two hours after placing to roughen slab surface to insure a permanent bond between base slab and applied materials.
8. Float Finish: Slabs to receive unbonded toppings, steel trowel finish, fill, mortar setting beds, or a built-up roof, and ramps, stair treads, platforms (interior and exterior), and equipment pads shall be floated to a smooth, dense uniform, sandy textured finish. During floating, while surface is still soft, check surface for flatness using a 3000 mm (10 foot) highway straightedge. Correct high spots by cutting down and correct low spots by filling in with material of same composition as floor finish. Remove any surface projections and re-float to a uniform texture.
9. Steel Trowel Finish: Concrete surfaces to receive resilient floor covering or carpet, monolithic floor slabs to be exposed to view in finished work, future floor roof slabs, applied toppings, and other interior surfaces for which no other finish is indicated. Steel trowel immediately following floating. During final troweling, tilt steel trowel at a slight angle and exert heavy pressure to compact

cement paste and form a dense, smooth surface. Finished surface shall be smooth, free of trowel marks, and uniform in texture and appearance.

10. Broom Finish: Finish exterior slabs, ramps, and stair treads with a bristle brush moistened with clear water after surfaces have been floated. Brush in a direction transverse to main traffic. Match texture approved by COTR from sample panel.
11. Finished slab flatness (FF) and levelness (FL) values comply with the following minimum requirements:
 - a. Areas covered with carpeting, or not specified otherwise in b. below:
 - 1) Slab on Grade:
 - a) Specified overall value FF 25 / FL 20
 - b) Minimum local value FF 17 / FL 15
 - 2) Level suspended slabs (shored until after testing) and topping slabs:
 - a) Specified overall value FF 25 / FL 20
 - b) Minimum local value FF 17 / FL 15
 - 3) Unshored suspended slabs:
 - a) Specified overall value FF 25
 - b) Minimum local value FF 17
 - 4) Level tolerance such that 80 percent of all points fall within a 20 mm (3/4 inch) envelope +10 mm, -10 mm (+3/8 inch, -3/8 inch) from the design elevation.
 - b. Areas that will be exposed, receive thin-set tile or resilient flooring, or roof areas designed as future floors:
 - 1) Slab on grade:
 - a) Specified overall value FF 36 / FL 20
 - b) Minimum local value FF 24 / FL 15
 - 2) Level suspended slabs (shored until after testing) and topping slabs
 - a) Specified overall value FF 30 / FL 20
 - b) Minimum local value FF 24 / FL 15
 - 3) Unshored suspended slabs:
 - a) Specified overall value FF 30
 - b) Minimum local value FF 24
 - 4) Level tolerance such that 80 percent of all points fall within a 20 mm (3/4 inch) envelope +10 mm, -10 mm (+3/8 inch, -3/8 inch) from the design elevation.

- c. "Specified overall value" is based on the composite of all measured values in a placement derived in accordance with ASTM E1155.
- d. "Minimum local value" (MLV) describes the flatness or levelness below which repair or replacement is required. MLV is based on the results of an individual placement and applies to a minimum local area. Minimum local area boundaries may not cross a construction joint or expansion joint. A minimum local area will be bounded by construction and/or control joints, or by column lines and/or half-column lines, whichever is smaller.

12. Measurements

- a. Department of Veterans Affairs retained testing laboratory will take measurements as directed by COTR, to verify compliance with FF, FL, and other finish requirements. Measurements will occur within 72 hours after completion of concrete placement (weekends and holidays excluded). Make measurements before shores or forms are removed to insure the "as-built" levelness is accurately assessed. Profile data for above characteristics may be collected using a laser level or any Type II apparatus (ASTM E1155, "profileograph" or "dipstick"). Contractor's surveyor shall establish reference elevations to be used by Department of Veterans Affairs retained testing laboratory.
- b. Contractor not experienced in using FF and FL criteria is encouraged to retain the services of a floor consultant to assist with recommendations concerning adjustments to slab thicknesses, finishing techniques, and procedures on measurements of the finish as it progresses in order to achieve the specific flatness and levelness numbers.

13. Acceptance/ Rejection:

- a. If individual slab section measures less than either of specified minimum local FF/FL numbers, that section shall be rejected and remedial measures shall be required. Sectional boundaries may be set at construction and contraction (control) joints, and not smaller than one-half bay.
- b. If composite value of entire slab installation, combination of all local results, measures less than either of specified overall FF/FL numbers, then whole slab shall be rejected and remedial measures shall be required.

14. Remedial Measures for Rejected Slabs: Correct rejected slab areas by grinding, planing, surface repair with underlayment compound or

repair topping, retopping, or removal and replacement of entire rejected slab areas, as directed by COTR, until a slab finish constructed within specified tolerances is accepted.

3.14 SURFACE TREATMENTS:

- A. Use on exposed concrete floors and concrete floors to receive carpeting except those specified to receive non-slip finish.
- B. Liquid Densifier/Sealer: Apply in accordance with manufacturer's directions just prior to completion of construction.
- C. Non-Slip Finish: Except where safety nosing and tread coverings are shown, apply non-slip abrasive aggregate to treads and platforms of concrete steps and stairs, and to surfaces of exterior concrete ramps and platforms. Broadcast aggregate uniformly over concrete surface at rate of application of 8% per 1/10th m² (7.5 percent per square foot) of area. Trowel concrete surface to smooth dense finish. After curing, rub treated surface with abrasive brick and water to slightly expose abrasive aggregate.

3.15 APPLIED TOPPING:

- A. Separate concrete topping on floor base slab of thickness and strength shown. Topping mix shall have a maximum slump of 200 mm (8 inches) for concrete containing a high-range water-reducing admixture (superplasticizer) and 100 mm (4 inches) for conventional mix. Neatly bevel or slope at door openings and at slabs adjoining spaces not receiving an applied finish.
- B. Placing: Place continuously until entire section is complete, struck off with straightedge, leveled with a highway straightedge or highway bull float, floated and troweled by machine to a hard dense finish. Slope to floor drains as required. Do not start floating until free water has disappeared and no water sheen is visible. Allow drying of surface moisture naturally. Do not hasten by "dusting" with cement or sand.

3.16 REPAIR AND PROTECTION:

- A. Repair and cure damaged finished surfaces of cast-in-place architectural concrete when approved by Architect. Match repairs to color, texture, and uniformity of surrounding surfaces and to repairs on approved mockups.
 - 1. Remove and replace cast-in-place architectural concrete that cannot be repaired and cured to Architect's approval.
- B. Protect corners, edges, and surfaces of cast-in-place architectural concrete from damage; use guards and barricades.

C. Protect cast-in-place architectural concrete from staining, laitance, and contamination during remainder of construction period.

- - - E N D - - -

THIS PAGE INTENTIONALLY LEFT BLANK

SECTION 04 05 13 MASONRY
MORTARING

PART 1 - GENERAL

1.1 DESCRIPTION:

Section specifies mortar materials and mixes.

1.2 RELATED WORK:

A. Mortar used in Section:

1. Section 04 05 16, MASONRY GROUTING.
2. Section 04 20 00, UNIT MASONRY.
3. Section 04 72 00, CAST STONE MASONRY.

B. Mortar Color: Section 09 06 00, SCHEDULE FOR

FINISHES. 1.3 TESTING LABORATORY-CONTRACTOR RETAINED

- A. Engage a commercial testing laboratory approved by COTR to perform tests specified below.
- B. Submit information regarding testing laboratory's facilities and qualifications of technical personnel to COTR.

1.4 TESTS

- A. Test mortar and materials specified.
- B. Certified test reports.
- C. Identify materials by type, brand name and manufacturer or by origin.
- D. Do not use materials until laboratory test reports are approved by Resident Engineer.
- E. After tests have been made and materials approved, do not change without additional test and approval of Resident Engineer.
- F. Testing:
 1. Test materials proposed for use for compliance with specifications in accordance with test methods contained in referenced specifications and as follows:
 2. Mortar:
 - a. Test for compressive strength and water retention; ASTM C270.
 - b. Mortar compressive strengths 28 days as follows:
 - Type M: Minimum 17230 kPa (2500 psi) at 28 days.
 - Type S: Minimum 12400 kPa (1800 psi) at 28 days.
 - Type N: Minimum 5170 kPa (750 psi) at 28 days.
 3. Cement:
 - a. Test for water soluble alkali (nonstaining) when nonstaining cement is specified.
 - b. Nonstaining cement shall contain not more than 0.03 percent water soluble alkali.

- 4. Sand: Test for deleterious substances, organic impurities, soundness and grading.
- 5. High Bond Mortar: Test for compressive strength, tensile strength, flexural strength, and brick bond strength.

1.5 SUBMITTALS

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Certificates:
 - 1. Testing laboratory's facilities and qualifications of its technical personnel.
 - 2. Indicating that following items meet specifications:
 - a. Portland cement.
 - b. Masonry cement.
 - c. Mortar cement.
 - d. Hydrated lime.
 - e. Fine aggregate (sand).
 - f. Color admixture.
- C. Laboratory Test Reports:
 - 1. Mortar, each type.
 - 2. Admixtures.
- D. Manufacturer's Literature and Data:
 - 1. Cement, each kind.
 - 2. Hydrated lime.
 - 3. Admixtures.
 - 4. Liquid acrylic resin.

1.6 PRODUCT DELIVERY, STORAGE AND HANDLING

- A. Deliver masonry materials in original sealed containers marked with name of manufacturer and identification of contents.
- B. Store masonry materials under waterproof covers on planking clear of ground, and protect damage from handling, dirt, stain, water and wind.

1.7 APPLICABLE PUBLICATIONS

- A. Publications listed below form a part of specification to extent referenced. Publications are referenced in text by basic designation only.
- B. American Society for Testing and Materials (ASTM):
 - C40-04 Organic Impurities in Fine Aggregates for
Concrete
 - C91-05 Masonry Cement

C109-07	.....	Compressive Strength of Hydraulic Cement Mortars (Using 2-in. or 50-MM Cube Specimens)
C144-04	.....	Aggregate for Masonry Mortar
C150-05	.....	Portland Cement
C207-06	.....	Hydrated Lime for Masonry Purposes
C270-07	.....	Mortar for Unit Masonry
C307-03	.....	Tensile Strength of Chemical - Resistant Mortar, Grouts, and Monolithic Surfacing
C321-00/R05	.....	Bond Strength of Chemical-Resistant Mortars
C348-02	.....	Flexural Strength of Hydraulic Cement Mortars
C595-08	.....	Blended Hydraulic Cement
C780-07	.....	Preconstruction and Construction Evaluation of Mortars for Plain and Reinforced Unit Masonry
C979-05	.....	Pigments for Integrally Colored Concrete
C1329-05	.....	Mortar Cement

PART 2 - PRODUCTS

2.1 HYDRATED LIME

ASTM C207, Type S.

2.2 AGGREGATE FOR MASONRY MORTAR

A. ASTM C144 and as follows:

1. Light colored sand for mortar for laying face brick.

B. Test sand for color value in accordance with ASTM C40. Sand producing color darker than specified standard is unacceptable.

2.3 BLENDED HYDRAULIC CEMENT

ASTM C595, Type IS, IP.

2.4 MASONRY CEMENT

ASTM C91. Type N, S, or M.

2.5 MORTAR CEMENT

ASTM C1329, Type N, S or M.

2.6 PORTLAND CEMENT

ASTM C150, Type I.

2.7 LIQUID ACRYLIC RESIN

A. A formulation of acrylic polymers and modifiers in liquid form designed for use as an additive for mortar to improve physical properties.

2.8 WATER

A. Potable, free of substances that are detrimental to mortar, masonry, and metal.

2.9 POINTING MORTAR

- A. For Cast Stone or Precast Concrete: Proportion by volume; One part white Portland cement, two parts white sand, and 1/5 part hydrated lime.

2.10 MASONRY MORTAR

- A. Conform to ASTM C270.
- B. Admixtures:
 - 1. Do not use mortar admixtures, except for high bond mortar, and color admixtures unless approved by COTR.
 - 2. Submit laboratory test report showing effect of proposed admixture on strength, water retention, and water repellency of mortar.
 - 3. Do not use antifreeze compounds.
- C. Colored Mortar:
 - 1. Maintain uniform mortar color for exposed work throughout.
 - 2. Match mortar color in approved sample.
- D. Color Admixtures:
 - 1. Proportion as specified by manufacturer.

2.11 HIGH BOND MORTAR

- A. Mixture by volume, one-part Portland cement, 1/4-part hydrated lime, three-parts sand, water, and liquid acrylic resin.
- B. Mortar properties when tested in accordance with referenced specifications.
 - 1. Compressive Strength, ASTM C109: Minimum 19,305 kPa (2800 psi), using 50 mm (2 inch) cubes.
 - 2. Tensile Strength, ASTM C307: 3861 kPa Minimum (560 psi), using the 25mm (1 inch) briquettes.
 - 3. Flexural Strength, ASTM C348: Minimum 6067 kPa (880 psi), using flexural bar.
 - 4. Bond Strength, ASTM C321: Minimum 2965 kPa (430 psi), using crossed brick.

2.12 COLOR ADMIXTURE

- A. Pigments: ASTM C979.
- B. Use mineral pigments only. Organic pigments are not acceptable.
- C. Pigments inert, stable to atmospheric conditions, nonfading, alkali resistant and water insoluble.

PART 3 - EXECUTION

3.1 MIXING

- A. Mix in a mechanically operated mortar mixer.
 - 1. Mix mortar for at least three minutes but not more than five minutes.

- B. Measure ingredients by volume. Measure by the use of a container of known capacity.
- C. Mix water with dry ingredients in sufficient amount to provide a workable mixture which will adhere to vertical surfaces of masonry units.
- D. Mortar that has stiffened because of loss of water through evaporations:
 - 1. Re-tempered by adding water to restore to proper consistency and workability.
 - 2. Discard mortar that has reached its initial set or has not been used within two hours.
- E. Pointing Mortar:
 - 1. Mix dry ingredients with enough water to produce a damp mixture of workable consistency which will retain its shape when formed into a ball.
 - 2. Allow mortar to stand in dampened condition for one to 1-1/2 hours.
 - 3. Add water to bring mortar to a workable consistency prior to application.

3.2 MORTAR USE LOCATION

- A. Use Type S mortar for setting cast stone and engineered reinforced unit masonry work.
- B. For brick veneer over frame back up walls, use Type N portland cement-lime mortar or Type S masonry cement or mortar cement mortar.
- C. Use Type N mortar for other masonry work, except as otherwise specified.
- D. Use pointing mortar for items specified. -

- - E N D - - -

THIS PAGE INTENTIONALLY LEFT BLANK

SECTION 04 20 00
UNIT MASONRY

PART 1 - GENERAL

1.1 DESCRIPTION

This section specifies requirements for construction of masonry unit walls.

1.2 RELATED WORK

- A. Mortars: Section 04 05 13, MASONRY MORTARING.
- B. Steel lintels and shelf angles: Section 05 50 00, METAL FABRICATIONS.
- C. Cavity insulation: Section 07 21 13, THERMAL INSULATION.
- D. Flashing: Section 07 60 00, FLASHING AND SHEET METAL.
- E. Sealants and sealant installation: Section 07 92 00, JOINT SEALANTS.

1.3 SUBMITTALS

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA AND SAMPLES.
- B. Samples:
 - 1. Face brick, sample panel, 200 mm by 400 mm (8 inches by 16 inches,) showing full color range and texture of bricks, bond, and proposed mortar joints.
 - 2. Concrete masonry units, when exposed in finish work.
 - 3. Anchors, and ties, one each and joint reinforcing 1200 mm (48 inches) long.
- C. Shop Drawings:
 - 1. Special masonry shapes.
 - 2. Drawings, showing reinforcement, applicable dimensions and methods of hanging soffit or lintel masonry and reinforcing masonry for embedment of anchors for hung fixtures.
 - 3. Shop Drawings: Submit shop drawings for fabrication, bending, and placement of reinforcing bars. Comply with ACI 315. Show bar schedules, diagrams of bent bars, stirrup spacing, lateral ties and other arrangements and assemblies as required for fabrication and placement of reinforcement for unit masonry work.
- D. Certificates:
 - 1. Certificates signed by manufacturer, including name and address of contractor, project location, and the quantity, and date or dates of shipment of delivery to which certificate applies.

- 2. Indicating that the following items meet specification requirements:
 - a. Face brick.
 - b. Solid and load-bearing concrete masonry units, including fire-resistant rated units.
- 3. Testing laboratories facilities and qualifications of its principals and key personnel to perform tests specified.

F. Manufacturer's Literature and Data:

- 1. Anchors, ties, and reinforcement.

1.4 MOCK-UP

- A. Before starting masonry, lay up a sample panel in accordance with Masonry Standards Joint Committee (MSJC) and Brick Industry Association (BIA).
 - 1. Use masonry units from random cubes of units delivered on site.
 - 2. Include reinforcing, ties, and anchors.
- B. Use mock-up panels approved by COTR for standard of workmanship of new masonry work.
- C. Use sample panel to test cleaning methods.

1.5 WARRANTY

Warrant exterior masonry walls against moisture leaks and subject to terms of "Warranty of Construction", FAR clause 52.246-21, except that warranty period shall be five years.

1.6 APPLICABLE PUBLICATIONS

- A. Publications listed below form a part of this specification to the extent referenced. Publications are referenced in the text by the basic designation only.
- B. American Society for Testing and Materials (ASTM):
 - A951-06 Steel Wire for Masonry Joint Reinforcement.
 - A615/A615M-07 Deformed and Plain Billet-Steel Bars for Concrete Reinforcement.
 - A675/A675M-03 Standard Specification for Steel Bars, Carbon, Hot-Wrought, Special Quality, Mechanical Properties
 - C34-03 Structural Clay Load-Bearing Wall Tile
 - C55-06 Concrete Building Brick
 - C56-05 Structural Clay Non-Load-Bearing Tile
 - C62-05 Building Brick (Solid Masonry Units Made From Clay or Shale)
 - C67-07 Sampling and Testing Brick and Structural Clay Tile

- C90-06 Load-Bearing Concrete Masonry Units
- C126-99 Ceramic Glazed Structural Clay Facing Tile,
Facing Brick, and Solid Masonry Units
- C216-07 Facing Brick (Solid Masonry Units Made From Clay
or Shale)
- C476-02 Standard Specification for Grout for Masonry
- C612-04 Mineral Fiber Block and Board Thermal Insulation
- C744-05 Prefaced Concrete and Calcium Silicate Masonry
Units.
- D1056-07 Flexible Cellular Materials - Sponge or Expanded
Rubber
- D2000-06 Rubber Products in Automotive Applications
- D2240-05 Rubber Property - Durometer Hardness
- D3574-05 Flexible Cellular Materials-Slab, Bonded, and
Molded Urethane Foams
- F1667-05 Fasteners: Nails, Spikes and Staples
- C. Masonry Industry Council:
All Weather Masonry Construction Manual, 2000.
- D. American Welding Society (AWS):
D1.4-05 Structural Welding Code - Reinforcing Steel.
- E. Federal Specifications (FS):
FF-S-107C-00 Screws, Tapping and Drive
- F. Brick Industry Association - Technical Notes on Brick Construction
(BIA):
- 11-1986 Guide Specifications for Brick Masonry, Part I
- 11A-1988 Guide Specifications for Brick Masonry, Part II
- 11B-1988 Guide Specifications for Brick Masonry, Part III
Execution
- 11C-1998 Guide Specification for Brick Masonry Engineered
Brick Masonry, Part IV
- 11D-1988 Guide Specifications for Brick Masonry
Engineered Brick Masonry, Part IV continued
- G. Masonry Standards Joint Committee; Specifications for Masonry Structures
(ACI 530.1-05/ASCE 6-05/TMS 602-99) (MSJC).

PART 2 - PRODUCTS

2.1 BRICK

- A. Face Brick:
1. ASTM C216, Grade SW, Type FBS.

2. Brick when tested in accordance with ASTM C67: Classified slightly efflorescent or better.

3. Size:

a. Modular

B. Manufacturer: Provide Robinson Brick Colonial Satin, Modular 7 5/8" (194 mm) x 3 5/8" (92 mm) x 2 1/4" (57 mm)

2.2 CONCRETE MASONRY UNITS

A. Solid Load-Bearing Concrete Masonry Units: ASTM C90.

1. Unit Weight: Normal weight.

2. Fire rated units for fire rated partitions.

3. Sizes: Modular.

4. For molded faces used as a finished surface, use concrete masonry units with uniform fine to medium surface texture unless specified otherwise.

2.3 SHEAR KEYS

A. ASTM D2000, solid extruded cross-shaped section of rubber, neoprene, or polyvinyl chloride, with a durometer hardness of approximately 80 when tested in accordance with ASTM D2240, and a minimum shear strength of 3.5 MPa (500 psi).

B. Shear key dimensions: Approximately 70 mm by 8 mm for long flange and 38 mm by 16 mm for short flange (2-3/4 inches by 5/16 inch for long flange, and 1-1/2 inches by 5/8 inch for short flange).

2.4 REINFORCEMENT:

A. Steel Reinforcing Bars: ASTM A615, deformed bars, 420 MPa (Grade 60) for bars No. 10 to No. 57 (No. 3 to No. 18), except as otherwise indicated.

B. Where 6 mm diameter (No. 2) bars are shown, provide plain, round, carbon steel bars, ASTM A675, 550 MPa (Grade 80).

C. Shop-fabricate reinforcement bars which are shown to be bent or hooked.

2.5 ANCHORS, TIES, AND REINFORCEMENT

A. Steel Reinforcing Bars: ASTM A615M, deformed bars, grade as shown.

B. Adjustable Veneer Anchor for Frame Walls:

1. Two piece, adjustable anchor and tie.

2. Anchor and tie may be either type; use only one type throughout.

3. Loop Type:

a. Anchor: Screw-on galvanized steel anchor strap 2.75 mm (0.11 inch) by 19 mm (3/4 inch) wide by 225 mm (9 inches) long, with 9 mm (0.35 inch) offset and 100 mm (4 inch) adjustment. Provide 5 mm (0.20 inch) hole at each end for fasteners.

- b. Ties: Triangular tie, fabricated of 5 mm (0.20 inch) diameter galvanized cold drawn steel wire. Ties long enough to engage the anchor and be embedded not less than 50 mm (2 inches) into the bed joint of the masonry veneer.

4. Angle Type:

- a. Anchor: Minimum 2 mm (16 gage) thick galvanized steel angle shaped anchor strap. Provide hole in vertical leg for fastener. Provide hole near end of outstanding leg to suit upstanding portion of tie.
- b. Tie: Fabricate from 5 mm (0.20 inch) diameter galvanized cold drawn steel wire. Form "L" shape to be embedded not less than 50 mm (2 inches) into the bed joint of the masonry veneer and provide upstanding leg to fit through hole in anchor and be long enough to allow 50 mm (2 inches) of vertical adjustment.

C. Dovetail Anchors:

1. Corrugated steel dovetail anchors formed of 1.5 mm (0.0598 inch) thick by 25 mm (1 inch) wide galvanized steel, 90 mm (3-1/2 inches) long where used to anchor 100 mm (4 inch) nominal thick masonry units, 140 mm (5-1/2 inches) long for masonry units more than 100 mm (4 inches) thick.
2. Triangular wire dovetail anchor 100 mm (4 inch) wide formed of 4 mm (9 gage) steel wire with galvanized steel dovetail insert. Anchor length to extend at least 75 mm (3 inches) into masonry, 25 mm (1 inch) into 40 mm (1-1/2 inch) thick units.
3. Form dovetail anchor slots from 0.6 mm (0.0239 inch) thick galvanized steel (with felt or fiber filler).

2.6 PREFORMED COMPRESSIBLE JOINT FILLER

- A. Thickness and depth to fill the joint as specified.
- B. Closed Cell Neoprene: ASTM D1056, Type 2, Class A, Grade 1, B2F1.
- C. Non-Combustible Type: ASTM C612, Class 5, 1800 degrees

F. 2.7 ACCESSORIES

- A. Weep Hole Wicks: Glass fiber ropes, 10 mm (3/8 inch) minimum diameter, 300 mm (12 inches) long.
- B. Masonry Cleaner:
 1. Detergent type cleaner selected for each type masonry used.
 2. Acid cleaners are not acceptable.
 3. Use soapless type specially prepared for cleaning brick or concrete masonry as appropriate.

C. Fasteners:

1. Concrete Nails: ASTM F1667, Type I, Style 11, 19 mm (3/4 inch) minimum length.
2. Masonry Nails: ASTM F1667, Type I, Style 17, 19 mm (3/4 inch) minimum length.
3. Screws: FS-FF-S-107, Type A, AB, SF thread forming or cutting.

PART 3 - EXECUTION

3.1 JOB CONDITIONS

A. Protection:

1. Cover tops of walls with nonstaining waterproof covering, when work is not in progress. Secure to prevent wind blow off.
2. On new work protect base of wall from mud, dirt, mortar droppings, and other materials that will stain face, until final landscaping or other site work is completed.

B. Cold Weather Protection:

1. Masonry may be laid in freezing weather when methods of protection are utilized.
2. Comply with MSJC and "Hot and Cold Weather Masonry Construction Manual".

3.2 CONSTRUCTION TOLERANCES

A. Lay masonry units plumb, level and true to line within the tolerances as per MSJC requirements and as follows:

B. Maximum variation from plumb:

1. In 3000 mm (10 feet) - 6 mm (1/4 inch).
2. In 6000 mm (20 feet) - 10 mm (3/8 inch).
3. In 12 000 mm (40 feet) or more - 13 mm (1/2 inch).

C. Maximum variation from level:

1. In any bay or up to 6000 mm (20 feet) - 6 mm (1/4 inch).
2. In 12 000 mm (40 feet) or more - 13 mm (1/2 inch).

D. Maximum variation from linear building lines:

1. In any bay or up to 6000 mm (20 feet) - 13 mm (1/2 inch).
2. In 12 000 mm (40 feet) or more - 19 mm (3/4 inch).

E. Maximum variation in cross-sectional dimensions of columns and thickness of walls from dimensions shown:

1. Minus 6 mm (1/4 inch).
2. Plus 13 mm (1/2 inch).

F. Maximum variation in prepared opening dimensions:

1. Accurate to minus 0 mm (0 inch).
2. Plus 6 mm (1/4 inch).

3.3 INSTALLATION GENERAL

- A. Keep finish work free from mortar smears or spatters, and leave neat and clean.
- B. Anchor masonry as specified in Paragraph, ANCHORAGE.
- C. Wall Openings:
 - 1. Fill hollow metal frames built into masonry walls and partitions solid with mortar as laying of masonry progresses.
 - 2. If items are not available when walls are built, prepare openings for subsequent installation.
- D. Tooling Joints:
 - 1. Do not tool until mortar has stiffened enough to retain thumb print when thumb is pressed against mortar.
 - 2. Tool while mortar is soft enough to be compressed into joints and not raked out.
 - 3. Finish joints in exterior face masonry work with a jointing tool, and provide smooth, water-tight concave joint unless specified otherwise.
 - 4. Tool Exposed interior joints in finish work concave unless specified otherwise.
- E. Lintels:
 - 1. Lintels are not required for openings less than 1000 mm (3 feet 4 inches) wide that have hollow metal frames.
 - 2. Openings 1025 mm (3 feet 5 inches) wide to 1600 m (5 feet 4 inches) wide with no structural steel lintel or frames, require a lintel formed of concrete masonry lintel or bond beam units filled with grout per ASTM C476 and reinforced with 1- #15m (1-#5) rod top and bottom for each 100 mm (4 inches) of nominal thickness unless shown otherwise.
 - 3. Precast lintels of 25 Mpa (3000 psi) concrete, of same thickness as partition, and with one Number 5 deformed bar top and bottom for each 100 mm (4 inches) of nominal thickness, may be used in lieu of reinforced CMU masonry lintels.
 - 4. Use steel lintels, for openings over 1600 m (5 feet 4 inches) wide, brick masonry, and elevator openings unless shown otherwise.
 - 5. Doors having overhead concealed door closers require a steel lintel, and a pocket for closer box.
 - 6. Length for minimum bearing of 100 mm (4 inches) at ends.
 - 7. Build masonry openings or arches over wood or metal centering and supports when steel lintels are not used.

F. Wall, Furring, and Partition Units:

1. Lay out field units to provide for running bond of walls and partitions, with vertical joints in second course centering on first course units unless specified otherwise.
2. Align head joints of alternate vertical courses.
3. At sides of openings, balance head joints in each course on vertical center lines of openings.
4. Use no piece shorter than 100 mm (4 inches) long.
5. On interior partitions provide a 6 mm (1/4 inch) open joint for caulking between exterior walls, concrete work, and abutting masonry partitions.
6. Use not less than 100 mm (4 inches) nominal thick masonry for free standing furring unless shown otherwise.
7. Do not abut existing plastered surfaces except suspended ceilings with new masonry partitions.

G. Use not less than 100 mm (4 inches) nominal thick masonry for fireproofing steel columns unless shown otherwise.

H. Before connecting new masonry with previously laid, remove loosened masonry or mortar, and clean and wet work in place as specified under wetting.

I. When new masonry partitions start on existing floors, machine cut existing floor finish material down to concrete surface.

J. Structural Steel Encased in Masonry:

1. Where structural steel is encased in masonry and the voids between the steel and masonry are filled with mortar, provide a minimum 25 mm (1 inch) mortar free expansion space between the masonry and the steel by applying a box board material to the steel before the masonry is laid.
2. Do not place spacing material where steel is bearing on masonry or masonry is bearing on steel.

K. Chases:

1. Do not install chases in masonry walls and partitions exposed to view in finished work, including painted or coated finishes on masonry.
2. Masonry 100 mm (4 inch) nominal thick may have electrical conduits 25 mm (1 inch) or less in diameter when covered with soaps, or other finishes.
3. Full recess chases after installation of conduit, with mortar and finish flush.
4. When pipes or conduits, or both occur in hollow masonry unit partitions retain at least one web of the hollow masonry units.

L. Wetting and Wetting Test:

1. Test and wet brick or clay tile in accordance with BIA 11B.
2. Do not wet concrete masonry units or glazed structural facing tile before laying.

M. Temporary Formwork: Provide formwork and shores as required for temporary support of reinforced masonry elements.

N. Construct formwork to conform to shape, line and dimensions shown. Make sufficiently tight to prevent leakage of mortar, grout, or concrete (if any). Brace, tie and support as required to maintain position and shape during construction and curing of reinforced masonry.

O. Do not remove forms and shores until reinforced masonry members have hardened sufficiently to carry their own weight and all other reasonable temporary loads that may be placed on them during construction.

P. Allow not less than the following minimum time to elapse after completion of members before removing shores or forms, provided suitable curing conditions have been obtained during the curing period.

1. 10 days for girders and beams.
2. 7 days for slabs.
3. 7 days for reinforced masonry

soffits. 3.4 ANCHORAGE

A. Veneer to Frame Walls:

1. Use adjustable veneer anchors.
2. Fasten anchor to stud through sheathing with self drilling and tapping screw, one at each end of loop type anchor.
3. Space anchors not more than 400 mm (16 inches) on center vertically at each stud.

B. Veneer to Concrete Walls:

1. Install dovetail slots in concrete vertically at 600 mm (2 feet) on centers.
2. Locate dovetail anchors at 400 mm (16 inch) maximum vertical intervals.
3. Anchor new masonry facing to existing concrete with corrugated wall ties spaced at 400 mm, (16 inch) maximum vertical intervals, and at 600 mm (2 feet) maximum horizontal intervals. Fasten ties to concrete with power actuated fasteners or concrete nails.

3.5 REINFORCEMENT

A. Joint Reinforcement:

1. Use as joint reinforcement in CMU wythe of combination brick and CMU, cavity walls, and single wythe concrete masonry unit walls or partitions.
2. Reinforcing may be used in lieu of individual ties for anchoring brick facing to CMU backup in exterior masonry walls.
3. Brick veneer over frame backing walls does not require joint reinforcement.
4. Locate joint reinforcement in mortar joints at 400 mm (16 inch) maximum vertical intervals.
5. Additional joint reinforcement is required in mortar joints at both 200 mm (8 inches) and 400 (16 inches) above and below windows, doors, louvers and similar openings in masonry, except where other type anchors are required for anchorage of masonry to concrete structure.
6. Joint reinforcement is required in every other course of stack bond CMU masonry.
7. Wherever brick masonry is backed up with stacked bond masonry, joint reinforcement is required in every other course of CMU backup, and in corresponding joint of facing brick.

B. Steel Reinforcing Bars:

1. Install in cells of hollow masonry units where required for vertical reinforcement and in bond beam units for lintels and bond beam horizontal reinforcement. Install in wall cavities of reinforced masonry walls where shown.
2. Use grade 60 bars if not specified otherwise.
3. Bond Beams:
 - a. Form Bond beams of load-bearing concrete masonry units filled with ASTM C476 grout and reinforced with 2-#15m (#5) reinforcing steel unless shown otherwise. Do not cut reinforcement.
 - b. Brake bond beams only at expansion joints and at control joints, if shown.
4. Stack Bond:
 - a. Locate additional joint reinforcement in vertical and horizontal joints as shown.
 - b. Anchor vertical reinforcement into the foundation or wall or bond beam below and hold in place.
 - c. Provide temporary bracing for walls over 8 ft. tall until permanent horizontal bracing is completed.

3.6 BRICK EXPANSION AND CMU CONTROL JOINTS.

- A. Provide brick expansion (BEJ) and CMU control (CJ) joints where shown on drawings.
- B. Keep joint free of mortar and other debris.
- C. Where joints occur in masonry walls.
 - 1. Install preformed compressible joint filler in brick wythe.
 - 2. Install cross shaped shear keys in concrete masonry unit wythe with preformed compressible joint filler on each side of shear key unless otherwise specified.
 - 3. Install filler, backer rod, and sealant on exposed faces.
- D. Use standard notched concrete masonry units (sash blocks) made in full and half-length units where shear keys are used to create a continuous vertical joint.
- E. Interrupt steel joint reinforcement at expansion and control joints unless otherwise shown.
- F. Fill opening in exposed face of expansion and control joints with sealant as specified in Section 07 92 00, JOINT SEALANTS.

3.7 BUILDING EXPANSION AND SEISMIC JOINTS

- A. Keep joint free of mortar. Remove mortar and other debris.
- B. Install non-combustible, compressible type joint filler to fill space completely except where sealant is shown on joints in exposed finish work.
- C. Where joints are on exposed faces, provide depth for backer rod and sealant as specified in Section 07 92 00, JOINT SEALANTS, unless shown otherwise.

3.8 ISOLATION SEAL

- A. Where full height walls or partitions lie parallel or perpendicular to and under structural beams or shelf angles, provide a separation between walls or partitions and bottom of beams or shelf angles not less than the masonry joint thickness unless shown otherwise.
- B. Insert in the separation, a continuous full width strip of non-combustible type compressible joint filler.
- C. Where exposed in finish work, cut back filler material in the joint enough to allow for the joint to be filled with sealant material specified in Section 07 92 00, JOINT SEALANTS.

3.9 BRICKWORK

A. Lay clay brick in accordance with BIA Technical Note 11 series.

B. Laying:

1. Lay brick in running bond with course of masonry bonded at corners unless shown otherwise.
2. Maintain bond pattern throughout.
3. Do not use brick smaller than half-brick at any angle, corner, break or jamb.
4. Where length of cut brick is greater than one half but less than a whole brick, maintain the vertical joint location of such units.
5. Lay exposed brickwork joints symmetrical about center lines of openings.
6. Do not structural bond multi wythe brick walls unless shown.
7. Before starting work, lay facing brick on foundation wall and adjust bond to openings, angles, and corners.
8. Lay brick for sills with wash and drip.
9. Build solid brickwork as required for anchorage of items.

C. Joints:

1. Exterior and interior joint widths: Lay for three equal joints in 200 mm (eight inches) vertically, unless shown otherwise.
2. Rake joints for pointing with colored mortar when colored mortar is not full depth.
3. Arches:
 - a. Flat arches (jack arches) lay with camber of 1 in 200 (1/16 inch per foot) of span.
 - b. Face radial arches with radial brick with center line of joints on radial lines.
 - c. Form Radial joints of equal width.
 - d. Bond arches into backing with metal ties in every other joint.

D. Weep Holes:

1. Install weep holes at 600 mm (24 inches) on center in bottom of vertical joints of exterior masonry veneer or cavity wall facing over foundations, bond beams, and other water stops in the wall.
2. Form weep holes using wicks made of mineral fiber insulation strips turned up 200 mm (8 inches) in cavity. Anchor top of strip to backup to securely hold in place.
3. Install sand or pea gravel in cavity approximately 75 mm (3 inches) high between weep holes.

E. Solid Exterior Walls:

1. Build with 100 mm (4 inches) of nominal thick facing brick, backed up with concrete masonry units.
2. Construct solid brick jambs not less than 20 mm (.8 inches) wide at exterior wall openings and at recesses, except where exposed concrete unit backup is shown.
3. Do not use full bonding headers.
4. Parging:
 - a. For solid masonry walls, lay backup to height of six brick courses, parge backup with 13 mm (1/2 inch) of mortar troweled smooth; then lay exterior wythe to height of backup.
 - b. Make parging continuous over backup, and extend 150 mm (six inches) onto adjacent concrete or masonry.
 - c. Parge, with mortar, the ends and backs for recesses in exterior walls to a thickness of 13 mm (1/2 inch).
 - d. Parge with mortar to true even surface the inside surface of exterior walls to receive insulation.

F. Cavity Type Exterior Walls:

1. Keep air space clean of mortar accumulations and debris.
 - a. Clean cavity by use of hard rubber, wood or metal channel strips having soft material on sides contacting wythes.
 - b. Lift strips with wires before placing next courses of horizontal joint reinforcement or individual ties or adjustable cavity wall ties.
2. For each lift lay two courses of concrete masonry units, followed by six courses of brick facing.
3. Lay the interior wythe of the masonry wall full height where dampproofing is required on cavity face. Coordinate to install dampproofing prior to laying outer wythe.
4. Veneer Framed Walls:
 - a. Build with 100 mm (4 inches) of face brick over sheathed stud wall with air space.
 - b. Keep air space clean of mortar accumulations and debris.

3.10 CONCRETE MASONRY UNITS**A. Kind and Users:**

1. Provide special concrete masonry shapes as required, including lintel and bond beam units, sash units, and corner units. Use solid concrete masonry units, where full units cannot be used, or where needed for anchorage of accessories.

2. Provide solid load-bearing concrete masonry units or grout the cell of hollow units at jambs of openings in walls, where structural members impose loads directly on concrete masonry, and where shown.
4. Do not use brick jambs in exposed finish work.
5. Use concrete building brick only as filler in backup material where not exposed.
6. Masonry assemblies shall meet the required fire resistance in fire rated partitions of type and construction that will provide fire rating as shown.

B. Laying:

1. Lay concrete masonry units with 10 mm (3/8 inch) joints, with a bond overlap of not less than 1/4 of the unit length, except where stack bond is required.
2. Do not wet concrete masonry units before laying.
3. Bond external corners of partitions by overlapping alternate courses.
4. Lay first course in a full mortar bed.
5. Set anchorage items as work progress.
6. Where ends of anchors, bolts, and other embedded items, project into voids of units, completely fill such voids with mortar or grout.
7. Provide a 6 mm (1/4 inch) open joint for caulking between exterior walls, concrete work, and abutting masonry partitions.
8. Lay concrete masonry units with full face shell mortar beds and fill head joint beds for depth equivalent to face shell thickness.
9. Lay concrete masonry units so that cores of units, that are to be filled with grout, are vertically continuous with joints of cross webs of such cores completely filled with mortar. Unobstructed core openings not less than 50 mm (2 inches) by 75 mm (3 inches).
10. Do not wedge the masonry against the steel reinforcing. Minimum 13 mm (1/2 inch) clear distance between reinforcing and masonry units.
11. Install deformed reinforcing bars of sizes shown.
12. Steel reinforcement, at time of placement, free of loose flaky rust, mud, oil, or other coatings that will destroy or reduce bond.
13. Steel reinforcement in place before grouting.
14. Minimum clear distance between parallel bars: One bar diameter.
15. Hold vertical steel reinforcement in place by centering clips, caging devices, tie wire, or other approved methods, vertically at spacings noted.
16. Support vertical bars near each end and at intermediate intervals not exceeding 192 bar diameters.
17. Reinforcement shall be fully encased by grout or concrete.

18. Splice reinforcement or attach reinforcement to dowels by placing in contact and secured or by placing the reinforcement within 1/5 of the required bar splice length.
19. Stagger splices in adjacent horizontal reinforcing bars. Lap reinforcing bars at splices a minimum of 40 bar diameters.
20. Grout cells of concrete masonry units, containing the reinforcing bars, solid as specified under grouting.
21. Cavity and joint horizontal reinforcement may be placed as the masonry work progresses.

3.11 POINTING

- A. Fill joints with pointing mortar using rubber float trowel to rub mortar solidly into raked joints.
- B. Wipe off excess mortar from joints of glazed masonry units with dry cloth.
- C. Finish exposed joints in finish work with a jointing tool to provide a smooth concave joint unless specified otherwise.

3.12 GROUTING

- A. Preparation:
 1. Clean grout space of mortar droppings before placing grout.
 2. Close cleanouts.
 3. Install vertical solid masonry dams across grout space for full height of wall at intervals of not more than 9000 mm (30 feet). Do not bond dam units into wythes as masonry headers.
 4. Verify reinforcing bars are in cells of units or between wythes as shown.
- B. Placing:
 1. Place grout by hand bucket, concrete hopper, or grout pump.
 2. Consolidate each lift of grout after free water has disappeared but before plasticity is lost.
 3. Do not slush with mortar or use mortar with grout.
 4. Interruptions:
 - a. When grouting must be stopped for more than an hour, top off grout 40 mm (1-1/2 inch) below top of last masonry course.
 - b. Grout from dam to dam on high lift method.
 - c. A longitudinal run of masonry may be stopped off only by raking back one-half a masonry unit length in each course and stopping grout 100 mm (4 inches) back of rake on low lift method.

C. Puddling Method:

1. Double wythe masonry constructed grouted in lifts not to exceed 300 mm (12 inches) or less than 50 mm (2 inches) wide.
2. Consolidate by puddling with a grout stick during and immediately after placing.
3. Grout the cores of concrete masonry units containing the reinforcing bars solid as the masonry work progresses.

D. Low Lift Method:

1. Construct masonry to a height of 1.5 m (5 ft) maximum before grouting.
2. Grout in one continuous operation and consolidate grout by mechanical vibration and reconsolidate after initial water loss and settlement has occurred.

E. High Lift Method:

1. Do not pour grout until masonry wall has properly cured a minimum of 4 hours.
2. Place grout in lifts not exceeding 1.5 m (5 ft).
3. Exception:
Where the following conditions are met, place grout in lifts not exceeding 3.86 m (12.67 ft).
 - a. The masonry has cured for at least 4 hours.
 - b. The grout slump is maintained between 254 and 279 mm (10 and 11 in).
 - c. No intermediate reinforced bond beams are placed between the top and the bottom of the pour height.
4. When vibrating succeeding lifts, extend vibrator 300 to 450 mm (12 to 18 inches) into the preceding lift to close any shrinkage cracks or separation from the masonry units.

3.13 PLACING REINFORCEMENT

- A. General: Clean reinforcement of loose rust, mill scale, earth, ice or other materials which will reduce bond to mortar or grout. Do not use reinforcement bars with kinks or bends not shown on the Contract Drawings or final shop drawings, or bars with reduced cross-section due to excessive rusting or other causes.
- B. Position reinforcement accurately at the spacing indicated. Support and secure vertical bars against displacement. Horizontal reinforcement may be placed as the masonry work progresses. Where vertical bars are shown in close proximity, provide a clear distance between bars of not less than the nominal bar diameter or 25 mm (1 inch), whichever is greater.

- C. For columns, piers and pilasters, provide a clear distance between vertical bars as indicated, but not less than 1 1/2 times the nominal bar diameter or 38 mm (1-1/2 inches), whichever is greater. Provide lateral ties as indicated.
- D. Splice reinforcement bars where shown; do not splice at other places unless accepted by the Resident Engineer. Provide lapped splices, unless otherwise indicated. In splicing vertical bars or attaching to dowels, lap ends, place in contact and wire tie.
- E. Provide not less than minimum lap as indicated on shop drawings, or if not indicated, as required by governing code.
- F. Weld splices where indicated. Comply with the requirements of AWS D1.4 for welding materials and procedures.
- G. Embed metal ties in mortar joints as work progresses, with a minimum mortar cover of 15 mm (5/8 inch) on exterior face of walls and 13 mm (1/2 inch) at other locations.
- H. Embed prefabricated horizontal joint reinforcement as the work progresses, with a minimum cover of 15 mm (5/8 inch) on exterior face of walls and 13 mm (1/2 inch) at other locations. Lap joint reinforcement not less than 150 mm (6 inches) at ends. Use prefabricated "L" and "T" sections to provide continuity at corners and intersections. Cut and bend joint reinforcement as recommended by manufacturer for continuity at returns, offsets, column fireproofing, pipe enclosures and other special conditions.
- I. Anchoring: Anchor reinforced masonry work to supporting structure as indicated.
- J. Anchor reinforced masonry walls to non-reinforced masonry where they intersect.

3.14 INSTALLATION OF REINFORCED CONCRETE UNIT MASONRY

- A. Do not wet concrete masonry units (CMU).
- B. Lay CMU units with full-face shell mortar beds. Fill vertical head joints (end joints between units) solidly with mortar from face of unit to a distance behind face equal to not less than the thickness of longitudinal face shells. Solidly bed cross-webs of starting courses in mortar. Maintain head and bed joint widths shown, or if not shown, provide 10 mm (3/8 inch) joints.
- C. Where solid CMU units are shown, lay with full mortar head and bed joints.

D. Walls:

1. Pattern Bond: Lay CMU wall units in 1/2-running bond with vertical joints in each course centered on units in courses above and below, unless otherwise indicated. Bond and interlock each course at corners and intersections. Use special-shaped units where shown, and as required for corners, jambs, sash, control joints, lintels, bond beams and other special conditions.
2. Maintain vertical continuity of core or cell cavities, which are to be reinforced and grouted, to provide minimum clear dimension indicated and to provide minimum clearance and grout coverage for vertical reinforcement bars. Keep cavities free of mortar. Solidly bed webs in mortar where adjacent to reinforced cores or cells.
3. Where horizontal reinforced beams (bond beams) are shown, use special units or modify regular units to allow for placement of continuous horizontal reinforcement bars. Place small mesh expanded metal lath or wire screening in mortar joints under bond beam courses over cores or cells of non-reinforced vertical cells, or provide units with solid bottoms.

E. Columns, Piers and Pilasters:

1. Use CMU units of the size, shape and number of vertical core spaces shown. If not shown, use units which provide minimum clearances and grout coverage for number and size of vertical reinforcement bars shown.
2. Provide pattern bond shown, or if not shown, alternate head joints in vertical alignment.
3. Where bonded pilaster construction is shown, lay wall and pilaster units together to maximum pour height specified.

F. Grouting:

1. Use "Fine Grout" per ASTM C476 for filling spaces less than 100 mm (4 inches) in one or both horizontal directions.
2. Use "Coarse Grout" per ASTM C476 for filling 100 mm (4 inch) spaces or larger in both horizontal directions.
3. Grouting Technique: At the Contractor's option, use either low-lift or high-lift grouting techniques subject to requirements which follow.

G. Low-Lift Grouting:

1. Provide minimum clear dimension of 50 mm (2 inches) and clear area of 5160 mm² (8 square inches) in vertical cores to be grouted.

2. Place vertical reinforcement prior to grouting of CMU. Extend above elevation of maximum pour height as required for splicing. Support in position at vertical intervals not exceeding 192 bar diameters nor 3 m (10 feet).
3. Lay CMU to maximum pour height. Do not exceed 1.5 m (5 foot) height, or if bond beam occurs below 1.5 m (5 foot) height, stop pour 38 mm (1-1/2 in) below top of bond beam.
4. Pour grout using chute container with spout or pump hose. Rod or vibrate grout during placing. Place grout continuously; do not interrupt pouring of grout for more than one hour. Terminate grout pours 38 mm (1-1/2 inches) below top course of pour.
5. Bond Beams: Stop grout in vertical cells 38 mm (1-1/2 inches) below bond beam course. Place horizontal reinforcement in bond beams; lap at corners and intersections as shown. Place grout in bond beam course before filling vertical cores above bond beam.

H. High-Lift Grouting:

1. Do not use high-lift grouting technique for grouting of CMU unless minimum cavity dimension and area is 75 mm (3 inches) and 6450 mm² (10 square inches), respectively.
2. Provide cleanout holes in first course at all vertical cells which are to be filled with grout.
3. Use units with one face shell removed and provide temporary supports for units above, or use header units with concrete brick supports, or cut openings in one face shell.
4. Construct masonry to full height of maximum grout pour specified, prior to placing grout.
5. Limit grout lifts to a maximum height of 1.5 m (5 feet) and grout pour to a maximum height of 7.3 m (24 feet), for single wythe hollow concrete masonry walls, unless otherwise indicated.
6. Place vertical reinforcement before grouting. Place before or after laying masonry units, as required by job conditions. Tie vertical reinforcement to dowels at base of masonry where shown and thread CMU over or around reinforcement. Support vertical reinforcement at intervals not exceeding 192 bar diameters nor 3 m (10 feet).
7. Where individual bars are placed after laying masonry, place wire loops extending into cells as masonry is laid and loosed before mortar sets. After insertion of reinforcement bar, pull loops and bar to proper position and tie free ends.

8. Where reinforcement is prefabricated into cage units before placing, fabricate units with vertical reinforcement bars and lateral ties of the size and spacing indicated.
9. Place horizontal beam reinforcement as the masonry units are laid.
10. Embed lateral tie reinforcement in mortar joints where indicated. Place as masonry units are laid, at vertical spacing shown.
11. Where lateral ties are shown in contact with vertical reinforcement bars, embed additional lateral tie reinforcement in mortar joints. Place as shown, or if not shown, provide as required to prevent grout blowout or rupture of CMU face shells, but provide not less than 4.1 mm diameter (8 gage) wire ties spaced 400 mm (16 inches) o.c. for members with 500 mm (20 inches) or less side dimensions, and 200 mm (8 inches) o.c. for members with side dimensions exceeding 500 mm (20 inches).
12. Preparation of Grout Spaces: Prior to grouting, inspect and clean grout spaces. Remove dust, dirt, mortar droppings, loose pieces of masonry and other foreign materials from grout spaces. Clean reinforcement and adjust to proper position. Clean top surface of structural members supporting masonry to ensure bond. After final cleaning and inspection, close cleanout holes and brace closures to resist grout pressures.
13. Do not place grout until entire height of masonry to be grouted has attained sufficient strength to resist displacement of masonry units and breaking of mortar bond. Install shores and bracing, if required, before starting grouting operations.
14. Place grout by pumping into grout spaces unless alternate methods are acceptable to the Resident Engineer.
15. Limit grout pours to sections which can be completed in one working day with not more than one hour interruption of pouring operation. Place grout in lifts which do not exceed 1.5 m (5 feet). Allow not less than 30 minutes, nor more than one hour between lifts of a given pour. Mechanically consolidate each grout lift during pouring operation.
16. Place grout in lintels or beams over openings in one continuous pour.
17. Where bond beam occurs more than one course below top of pour, fill bond beam course to within 25 mm (1 inch) of vertically reinforced cavities, during construction of masonry.

18. When more than one pour is required to complete a given section of masonry, extend reinforcement beyond masonry as required for splicing. Pour grout to within 38 mm (1-1/2 inches) of top course of first pour. After grouted masonry is cured, lay masonry units and place reinforcement for second pour section before grouting. Repeat sequence if more pours are required.

3.15 CLEANING AND REPAIR

A. General:

1. Clean exposed masonry surfaces on completion.
2. Protect adjoining construction materials and landscaping during cleaning operations.
3. Cut out defective exposed new joints to depth of approximately 19 mm (3/4 inch) and repoint.
4. Remove mortar droppings and other foreign substances from wall surfaces.

B. Brickwork:

1. First wet surfaces with clean water, then wash down with a solution of soapless detergent. Do not use muriatic acid.
2. Brush with stiff fiber brushes while washing, and immediately thereafter hose down with clean water.
3. Free clean surfaces of traces of detergent, foreign streaks, or stains of any nature.

C. Concrete Masonry Units:

1. Immediately following setting, brush exposed surfaces free of mortar or other foreign matter.
2. Allow mud to dry before brushing. - -

- E N D - - -

THIS PAGE INTENTIONALLY LEFT BLANK

**SECTION 04 72 00
CAST STONE MASONRY**

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This sections specifies manufactured concrete units to simulate a natural stone.
- B. Installation of cast stone units.

1.2 RELATED WORK

- A. Setting and pointing mortar: Section 04 05 13, MASONRY MORTARING.
- B. Joint sealant and application: Section 07 92 00, JOINT SEALANTS.

1.3 SUBMITTALS

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Samples:
 - 1. Cast stone, sample panel, size 100 by 300 by 300 mm (4 by 12 by 12 inches) each color and finish.
 - 2. Show finish on two 100 mm (4-inch) edges and 300 by 300 mm (12 by 12 inch) surface.
- C. Shop Drawings:
 - 1. Cast stone showing exposed faces, profiles, cross sections, anchorage, reinforcing, jointing and sizes.
 - 2. Setting drawings with setting mark.
- D. Certificates: Test results indicating that the cast stone meets specification requirements and proof of plant certification.
- E. Submit manufacturers test results of cast stone previously made by manufacturer.
- F. Laboratory Data: Description of testing laboratories facilities and qualifications of its principals and key personnel.
- G. List of jobs furnished by the manufacturer, which were similar in scope and at least three (3) years of age.
- H. Mock-up.

1.4 PRODUCT DELIVERY, STORAGE AND HANDLING

- A. Store cast stone under waterproof covers on planking clear of ground.
- B. Protect from handling, dirt, stain, and water damage.
- C. Mark production units with the identification marks as shown on the shop drawings.
- D. Package units and protect them from staining or damage during shipping and storage.
- E. Provide an itemized list of product to support the bill of lading.

1.5 WARRANTY

Warranty exterior masonry walls against moisture leaks, any defects and subject to terms of "Warranty of Construction", FAR clause 52.246-21, except that warranty period shall be two years.

1.6 APPLICABLE PUBLICATIONS

- A. Publications listed below form a part of this specification to extent referenced. Publications are referenced in text by the basic designation only. Comply with applicable provisions and recommendations of the following, except as otherwise shown or specified.
- B. Cast Stone Institute Technical Manual and Cast Stone Institute standard specifications.
- C. American Society for Testing and Materials (ASTM):
- A167-99 (2004) Stainless and Heat Resisting Chromium-Nickel Steel Plate, Sheet, and Strip
 - A185-07 Steel, Welded Wire Fabric, Plain for Concrete
 - A615/A615M-08 Deformed and Plain Billet-Steel Bars for Concrete Reinforcement
 - C33-07 Concrete Aggregates
 - C150-07 Portland Cement
 - C503-08 Marble Dimension Stone (Exterior)
 - C568-08 Limestone Dimension Stone
 - C615-03 Granite Dimension Stone
 - C616-08 Quartz-Based Dimension Stone
 - C979-05 Pigments for Integrally Colored Concrete
 - C1194-06 Compressive Strength of Architectural Cast Stone
 - C1195-03 Absorption of Architectural Cast Stone
 - C1364-07 Architectural Cast Stone.
 - D2244-07 Calculation of Color Differences from Instrumentally Measured Color Coordinates.

1.7 QUALITY ASSURANCE

- A. The Manufacturer:
1. Must have ten (10) years minimum continuous operating experience and have facilities for manufacturing cast stone as described herein. Manufacturer shall have sufficient plant facilities to produce the shapes, quantities and size of cast stone required in accordance with the project schedule.
 2. Must be a member of the Cast Stone Institute.
 3. Must have a certified plant (certification by the Cast Stone Institute).

- B. Stone setter: Must have ten (10) years experience setting cast or natural building stone.
- C. Testing: One (1) sample from production units may be selected at random from the field for each 500 cubic feet (14 m³) delivered to the job:
 1. Three (3) field cut cube specimens from each of these sample shall have an average minimum compressive strength of not less than 85% with no single specimen testing less than 75% of design strength as specified.
 2. Three (3) field cut cube specimens from each of these samples shall have an average maximum cold-water absorption of 6%.
 3. Field specimens shall be tested in accordance with ASTM C 1194 and C 1195.
 4. Manufacturer shall submit a written list of projects similar and at least three (3) years of age, along with owner, architect and contractor references.

1.8 MANUFACTURING TOLERANCES

- A. Cross section dimensions shall not deviate by more than + 1/8 in. (3 mm) from approved dimension.
- B. Length of units shall not deviate by more than length /360 or + 1/8 in. (3mm), whichever is greater, not to exceed + 1/4 in (6 mm). Maximum length of any unit shall not exceed 15 times the average thickness of such unit unless otherwise agreed by the manufacturer.
- C. Warp bow or twist of units shall not exceed length/360 or + 1/8 in. (3 mm), whichever is greater.
- D. Location of dowel holes, anchor slots, flashing grooves, false joints and similar features - On formed sides of unit, 1/8 in (3 mm), on unformed sides of unit, 3/8 in (9 mm) maximum deviation.

1.9 MOCK-UP

Provide full size unit(s) for use in construction of sample wall. The mock-up becomes the standard of workmanship for the project.

PART 2 - PRODUCTS

2.1 ARCHITECTURAL CAST STONE

- A. Basis-of-Design: Arriscraft Renaissance, Sand Drift, texture and size as indicated on Drawings.
- B. Comply with ASTM C 1364
- C. Physical properties: Provide the following:
 1. Compressive Strength - ASTM C 1194: 6,500 psi (45 Mpa) minimum for products at 28 days.

2. Absorption - ASTM C 1195: 6% maximum by the cold water method, or 10% maximum by the boiling method for products as 28 days.
3. Air Content - ASTM C173 or C231, for wet cast product shall be 4-8% for units exposed to freeze-thaw environments. Air entrainment is not required for vibrant dry tamp (VDT) products.
4. Freeze thaw - ASTM C 1364L The cumulative percent weight loss (CPWL) shall be less than 5% after 300 cycles of freezing and thawing.
5. Linear Shrinkage - ASTM C 426L Shrinkage shall not exceed 0.065%. D. Job site testing - One (1) sample from production units may be selected at random from the field for each 500 cubic feet (14m³) delivered to the job site:
 1. Three (3) field cut cube specimens from each of these samples shall have an average minimum compressive strength of not less than 85% with no single specimen testing less than 75% of design strength as allowed by ACI 318.
 2. Three (3) field cut cube specimens from each of these samples shall have an average maximum cold-water absorption of 6%.
 3. Field specimens shall be tested in accordance with ASTM C 1194 and C 1195.

2.2 RAW MATERIALS

- A. Portland cement - Type I or Type III, white and/or grey, ASTM C 150.
- B. Coarse aggregates - Granite, quartz or limestone, ASTM C 33, except for gradation, and are optional for the vibrant dry tamp (VDT) casting method.
- C. Fine aggregates - Manufactured or natural sands, ASTM C 33, except for gradation.
- D. Colors - Inorganic iron oxide pigments, ASTM C 979 except that carbon black pigments shall not be used.
- E. Admixtures- Comply with the following:
 1. ASTM C 260 for air-entraining admixtures.
 2. ASTM C 494/C 495 M Types A-G for water reducing, retarding, accelerating and high range admixtures.
 3. Other admixtures: integral water repellents and other chemicals, for which no ASTM Standard exists, shall be previously established as suitable for use in concrete by proven field performance or through laboratory testing.
 4. ASTM C 618 mineral admixtures of dark and variable colors shall not be used in surfaces intended to be exposed to view.

5. ASTM C 989 granulated blast furnace slag may be used to improve physical properties. Tests are required to verify these features.

F. Water - Potable

G. Reinforcing bars:

1. ASTM A 615/A 615M. Grade 40 or 60 steel galvanized or epoxy coated when cover is less than 1.5 in. (37 mm).

2. Welded Wire Fabric: ASTM A 185 where applicable for wet cast units.

H. All anchors, dowels and other anchoring devices and shims shall be standard building stone anchors commercially available in a non-corrosive material such as zinc plated, galvanized steel, brass, or stainless steel Type 302 or 304.

2.3 COLOR AND FINISH

A. Match sample on file.

B. All surfaces intended to be exposed to view shall have a fine-grained texture similar to natural stone, with no air voids in excess of 1/32 in. (0.8 mm) and the density of such voids shall be less than 3 occurrences per any 1 in² (25mm²) and not obvious under direct daylight illumination at a 5 ft. (1.5m) distance.

C. Units shall exhibit a texture approximately equal to the approved sample when viewed under direct daylight illumination at a 10 ft (3m) distance.

D. ASTM D 2244 permissible variation in color between units of comparable age subjected to similar weathering exposure.

1. Total color difference - not greater than 6 units.

2. Total hue difference-not greater than 2 units.

2.4 REINFORCING

A. Reinforce the units as required by the drawings and for safe handling and structural stress.

1. Minimum reinforcing shall be 0.25 percent of the cross section area.

B. Reinforcement shall be non-corrosive where faces exposed to weather are covered with less than 1.5in. (38 mm) of concrete material. All reinforcement shall have minimum coverage of twice the diameter of the bars.

C. Minor chipping resulting from shipment and delivery shall not be grounds for rejection. Minor chips shall not be obvious under direct daylight illumination from a 20-ft (6m) distance.

D. The occurrence of crazing or efflorescence shall not constitute a cause for rejection.

E. Remove cement film, if required, from exposed surface prior to packaging for shipment.

2.5 CURING

- A. Cure units in a warm curing chamber 1000 F (537.8 C) at 95 percent relative humidity for approximately 12 hours, or cure in a 95 percent moist environment at a minimum 700F (371.1 C) for 16 hours after casting. Additional yard curing at 95 percent relative humidity shall be 350-degree-days (i.e. 7 days @ 500F (260.0 C) or 5 days @ 700F (371.1 C) prior to shipping. Form cured units shall be protected from moisture evaporation with curing blankets or curing compounds after casting.

PART 3 - EXECUTION

3.1 EXAMINATION

Installing contractor shall check cast stone materials for fit and finish prior to installation. Do not set unacceptable units.

3.2 SETTING TOLERANCES

- A. Comply with Cast Stone Institute SM Technical Manual.
 B. Set stones 1/8 in. (3 mm) or less, within the plane of adjacent units.
 C. Joints, plus - 1/6 in. (1.5 mm), minus - 1/8 in. (3

mm). 3.3 JOINTING

- A. Joint size:
1. At stone/brick joints 3/8 in. (9.5 mm).
 2. At stone/stone joints in vertical position 3/8 in. (9.5 mm).
 3. Stone/stone joint exposed on top 3/8 in. (9.5 mm).
- B. Joint Materials:
1. Mortar, Type N, ASTM C 270.
 2. Use a full bed of mortar at all bed joints.
 3. Flush vertical joints full with mortar.
 4. Leave all joints with exposed tops or under relieving angles open for sealant.
 5. Leave head joints in coping and projecting components open for sealant.
- C. Location of joints:
1. As shown on shop drawings.
 2. At control and expansion joints unless otherwise shown.

3.4 SETTING

- A. Drench units with clean water prior to setting.
 B. Fill dowel holes and anchor slots completely with mortar or non-shrink grout.
 C. Set units in full bed of mortar, unless otherwise detailed.
 D. Rake mortar joints 3/4 in. (18 mm) for pointing.
 E. Remove excess mortar from unit faces immediately after setting.

F. Tuck point unit joints to a slight concave profile. **3.5 JOINT PROTECTION**

- A. Comply with requirements of Section 07 92 00, JOINT SEALANTS.
- B. Prime ends of units, insert properly sized backing rod and install required sealant. **3.6 REPAIR AND CLEANING**

- A. Repair chips with touchup materials furnished by manufacturer.
- B. Saturate units to be cleaned prior to applying an approved masonry cleaner.
- C. Consult with manufacturer for appropriate cleaners.

3.7 INSPECTION AND ACCEPTANCE

Inspect finished installation according to Bulletin #36 published by the Cast Stone Institute.

- - - E N D - - -

THIS PAGE INTENTIONALLY LEFT BLANK

**SECTION 05 12 00
STRUCTURAL STEEL FRAMING**

PART 1 - GENERAL

1.1 DESCRIPTION:

This section specifies structural steel shown and classified by Section 2, Code of Standard Practice for Steel Buildings and Bridges.

1.2 RELATED WORK:

- A. Materials testing and inspection during construction: Section 01 45 29, TESTING LABORATORY SERVICES.
- B. Painting: Section 09 91 00, PAINTING.
- C. Steel Joist: Section 05 21 00, STEEL JOIST FRAMING.
- D. Steel Decking: Section 05 31 00, STEEL DECKING.
- E. Fireproofing: Section 07 81 00, APPLIED FIREPROOFING.

1.3 QUALITY ASSURANCE:

- A. Fabricator and erector shall maintain a program of quality assurance in conformance with Section 8, Code of Standard Practice for Steel Buildings and Bridges. Work shall be fabricated in an AISC certified Category Conventional Steel Structures fabrication plant.
- B. Before authorizing the commencement of steel erection, the controlling contractor shall ensure that the steel erector is provided with the written notification required by 29 CFR 1926.752. Provide copy of this notification to the COTR.

1.4 TOLERANCES:

Fabrication tolerances for structural steel shall be held within limits established by ASTM A6, by Section 7, Code of Standard Practice for Buildings and Bridges, and by Standard Mill Practice - General Information (AISC ASD Manual, Ninth Edition, Page 1-145, except as follows:

- A. Elevation tolerance for column splice points at time member is erected is 10 mm (3/8 inch).
- B. Elevation tolerance for top surface of steel beams and girders at connections to columns at time floor is erected is 13 mm (1/2 inch).
- C. Elevation tolerance for closure plates at the building perimeter and at slab openings prior to concrete placement is 6 mm (1/4 inch).

1.5 DESIGN:

- A. Connections: Design and detail all connections for each member size, steel grade and connection type to resist the loads and reactions indicated on the drawings or specified herein. Use details consistent with the details shown on the Drawings, supplementing where necessary.

The details shown on the Drawings are conceptual and do not indicate the required weld sizes or number of bolts unless specifically noted. Use rational engineering design and standard practice in detailing, accounting for all loads and eccentricities in both the connection and the members. Promptly notify the COTR of any location where the connection design criteria is not clearly indicated. The design of all connections is subject to the review and acceptance of the COTR. Submit structural calculations prepared and sealed by a qualified engineer registered in the state where the project is located. Submit calculations for review before preparation of detail drawings.

1.6 REGULATORY REQUIREMENTS:

- A. AISC: Specification for Structural Steel Buildings - Allowable Stress Design.
- B. AISC: Code of Standard Practice for Steel Buildings and Bridges.

1.7 SUBMITTALS:

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Shop and Erection Drawings: Complete
- C. Certificates:
 - 1. Structural steel.
 - 2. Steel for all connections.
 - 3. Welding materials.
 - 4. Shop coat primer paint.
- D. Test Reports:
 - 1. Welders' qualifying tests.

1.8 APPLICABLE PUBLICATIONS:

- A. Publications listed below form a part of this specification to extent referenced. Publications are referenced in text by basic designation only.
- B. American Institute of Steel Construction (AISC):
 - 1. Specification for Structural Steel Buildings - Allowable Stress Design and Plastic Design (Ninth Edition, 1989)
 - 2. Load and Resistance Factor Design Specification for Structural Steel Buildings (Second Edition, 1995)
 - 3. Code of Standard Practice for Steel Buildings and Bridges (March 2000).

C. American National Standards Institute (ANSI):

B18.22.1-98 Plain Washers

B18.22M-00 Metric Plain Washers

D. American Society for Testing and Materials (ASTM):

A6/A6M-02 Standard Specification for General Requirements
for Rolled Structural Steel Bars, Plates,
Shapes, and Sheet Piling

A36/A36M-01 Standard Specification for Carbon Structural
Steel

A53/A53M-01 Standard Specification for Pipe, Steel, Black
and Hot-Dipped, Zinc-Coated Welded and Seamless

A123/A123M-02 Standard Specification for Zinc (Hot-Dip
Galvanized) Coatings on Iron and Steel Products

A242/A242M-01 Standard Specification for High-Strength Low-
Alloy Structural Steel

A283/A283M-00 Standard Specification for Low and Intermediate
Tensile Strength Carbon Steel Plates

A307-00 Standard Specification for Carbon Steel Bolts
and Studs, 60,000 psi Tensile Strength

A325-02 Standard Specification for Structural Bolts,
Steel, Heat Treated, 120/105 ksi Minimum Tensile
Strength

A490-02 Standard Specification for Heat-Treated Steel
Structural Bolts 150 ksi Minimum Tensile
Strength

A500-01 Standard Specification for Cold Formed Welded
and Seamless Carbon Steel Structural Tubing in
Rounds and Shapes

A501-01 Standard Specification for Hot-Formed Welded and
Seamless Carbon Steel Structural Tubing

A572/A572M-01 Standard Specification for High-Strength
Low-Alloy Columbium-Vanadium Structural Steel

A992/A992M-02 Standard Specification for Structural Steel Shapes

E. American Welding Society (AWS):

D1.1-02 Structural Welding Code-Steel

F. Research Council on Structural Connections (RCSC) of The Engineering
Foundation:

Specification for Structural Joints Using ASTM A325 or A490 Bolts

G. Military Specifications (Mil. Spec.):

MIL-P-21035 Paint, High Zinc Dust Content, Galvanizing, Repair

- H. Occupational Safety and Health Administration (OSHA):
29 CFR Part 1926-2001 ..Safety Standards for Steel Erection

PART 2 - PRODUCTS

2.1 MATERIALS:

- A. Structural Steel: ASTM A36, or A992.
- B. Structural Tubing: ASTM A500, Grade B.
- C. Structural Tubing: ASTM A501.
- D. Steel Pipe: ASTM A53, Grade B.
- E. Bolts, Nuts and Washers:
 - 1. High-strength bolts, including nuts and washers: ASTM A325.
 - 2. Bolts and nuts, other than high-strength: ASTM A307, Grade A.
 - 3. Plain washers, other than those in contact with high-strength bolt heads and nuts: ANSI Standard B18.22.1.
- F. Zinc Coating: ASTM A123.
- G. Galvanizing Repair Paint: Mil. Spec. MIL-P-21035.

PART 3 - EXECUTION

3.1 CONNECTIONS (SHOP AND FIELD):

- A. Welding: Welding in accordance with AWS D1.1. Welds shall be made only by welders and welding operators who have been previously qualified by tests as prescribed in AWS D1.1 to perform type of work required.
- B. High-Strength Bolts: High-strength bolts tightened to a bolt tension not less than proof load given in Specification for Structural Joints Using ASTM A325 or A490 Bolts. Tightening done with properly calibrated wrenches, by turn-of-nut method or by use of direct tension indicators (bolts or washers). Tighten bolts in connections identified as slip-critical using Direct Tension Indicators or the turn-of-the-nut method. Twist-off torque bolts are not an acceptable alternate fastener for slip critical connections.

3.2 FABRICATION:

Fabrication in accordance with Chapter M, Specification for Steel Buildings - Allowable Stress Design and Plastic Design.

3.3 SHOP PAINTING:

- A. General: Shop paint steel with primer in accordance with Section 6, Code of Standard Practice for Steel Buildings and Bridges.
- B. Shop paint for steel surfaces is specified in Section 09 91 00, PAINTING.
- C. Do not apply paint to following:
 - 1. Surfaces within 50 mm (2 inches) of joints to be welded in field.
 - 2. Surfaces which will be encased in concrete.

- 3. Surfaces which will receive sprayed on fireproofing.
- 4. Top flange of members which will have shear connector studs applied.
- D. Structural steel in the interstitial space that does not receive sprayed on fireproofing shall be painted with primer in accordance with general requirement of shop painting.
- E. Zinc Coated (Hot Dip Galvanized) per ASTM A123 (after fabrication):
Touch-up after erection: Clean and wire brush any abraded and other spots worn through zinc coating, including threaded portions of bolts and welds and touch-up with galvanizing repair paint.

3.4 ERECTION:

- A. General: Erection in accordance with Section 7, Code of Standard Practice for Steel Buildings and Bridges.
- B. Temporary Supports: Temporary support of structural steel frames during erection in accordance with Section 7, Code of Standard Practice for Steel Buildings and Bridges.

3.5 FIELD PAINTING:

- A. After erection, touch-up steel surfaces specified to be shop painted. After welding is completed, clean and prime areas not painted due to field welding.
- B. Finish painting of steel surfaces is specified in Section 09 91 00, PAINTING.

3.6 SURVEY:

Upon completion of finish bolting or welding on any part of the work, and prior to start of work by other trades that may be supported, attached, or applied to the structural steel work, submit a certified report of survey to COTR for approval. Reports shall be prepared by Registered Land Surveyor or Registered Civil Engineer as specified in Section 01 00 00, GENERAL REQUIREMENTS. Report shall specify that location of structural steel is acceptable for plumbness, level and alignment within specified tolerances specified in the AISC Manual.

- - - E N D - - -

THIS PAGE INTENTIONALLY LEFT BLANK

**SECTION 05 21 00
STEEL JOIST FRAMING**

PART 1 - GENERAL

1.1 DESCRIPTION:

This section specifies open web, longspan, and joist girders.

1.2 RELATED WORK:

- A. Structural Steel: Section 05 12 00, STRUCTURAL STEEL FRAMING.
- B. Finish Painting: Section 09 91 00, PAINTING.

1.3 DESIGN REQUIREMENTS:

Design all elements with the latest published version of applicable Codes.

1.4 TOLERANCES:

Deviation from a straight line between ends of any installed joist shall not exceed 10 mm in 3 m (3/8 inch in 10 feet).

1.5 REGULATORY REQUIREMENTS:

STEEL JOIST INSTITUTE: Standard Specifications, Load Tables and Weight Tables for Steel Joists and Joist Girders, (Latest Edition).

1.6 SUBMITTALS:

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Shop and Erection Drawings: Complete.
 - 1. Fabrication drawings including details and schedules for the fabrication and assembly of each joist.
 - 2. Erection drawings showing the size and location of each joist, bridging, cross bracing, bearing details, connections, welds, bolts and bearing plates.
- C. Certificates: STEEL JOIST INSTITUTE compliance.
- D. Design Calculations: If requested by the Resident Engineer, submit complete calculations covering the design of all members and connections. Calculations must be specifically applicable to the joists supplied.

1.7 QUALITY ASSURANCE:

Provide documentation that the joist manufacturer is a member of the Steel Joist Institute and has satisfactorily completed work of a similar scope and nature.

1.8 APPLICABLE PUBLICATIONS:

- A. Publications listed below form a part of this specification to extent referenced. Publications are referenced in text by basic designation only.

- B. American Institute of Steel Construction (AISC):
 - 1. Specification for Structural Steel Buildings - Allowable Stress Design and Plastic Design (Latest Edition).
 - 2. Load and Resistance Factor Design Specification for Structural Steel Buildings (Latest Edition).
- C. American Society for Testing and Materials (ASTM):
 - A307-07 Carbon Steel Bolts and Studs, 400 MPa (60,000 psi) Tensile Strength
 - A325-09 Structural Bolts, Steel, Heat Treated, 800/700 MPa (120/105 ksi) Minimum Tensile Strength
 - A490-08 Heat-Treated Steel Structural Bolts, 1000 MPa (150 ksi) Minimum Tensile Strengths
- D. American Welding Society (AWS):
 - D1.1-08 Structural Welding Code - Steel
- E. SSPC: The Society for Protective Coatings:
 - Steel Structures Painting Manual, Volumes 1 and 2
- F. Steel Joist Institute (STEEL JOIST INSTITUTE):
 - Standard Specifications, Load Tables and Weight Tables for Steel Joists and Joist Girders (Latest Edition).
- G. U.S. Army Corps of Engineers:
 - CRD-C-621 Specification for Non-Shrink Grout

PART 2 - PRODUCTS

2.1 OPEN WEB STEEL JOISTS:

K-Series conforming to STEEL JOIST INSTITUTE standard specifications.

2.2 LONGSPAN STEEL JOISTS:

LH-Series conforming to STEEL JOIST INSTITUTE standard specifications.

2.3 ACCESSORIES - FITTINGS:

- A. Accessories and fittings, including end supports and bridging, in accordance with standard STEEL JOIST INSTITUTE specification under which joists were designed.
- B. Unfinished Threaded Fasteners: ASTM A307, Grade A, regular hexagon type, low carbon steel.
- C. High-strength bolts, including nuts and washers: ASTM A325 or A490 heavy hexagon structural bolts.

2.4 BEDDING MORTAR:

- A. For joist ends bearing on concrete or masonry, provide bedding mortar as follows:
 - 1. Non-metallic, shrinkage-resistant mortar; premixed, non-corrosive, non-staining product containing selected silica sands, portland

cement, shrinkage compensating agents, plasticizing and water reducing agents, complying with CRD-C-621.

PART 3 - EXECUTION

3.1 FABRICATION:

A. Fabrication and assembly in accordance with applicable standard STEEL JOIST INSTITUTE specification:

1. Make chord splices with full penetration welds capable of developing the ultimate strength in tension of the parent material. Make no allowance for the strength of back-up bars or other material incidental to welding.
2. Provide shop-welded connection plates at panel points to receive supplemental framing.
3. Holes in Chord Members: Provide holes in chord members where shown for securing other work to steel joists; however, deduct area of holes from the area of chord when calculating strength of member.
4. Extended Ends: Provide extended ends on joists where shown, complying with manufacturer's standards and requirements of applicable STEEL JOIST INSTITUTE specifications.
5. Ceiling Extensions: Provide ceiling extension in areas having ceilings attached directly to joist bottom chord. Provide either an extended bottom chord element or a separate unit, to suit manufacturer's standards, of sufficient strength to support ceiling construction. Extend ends to within 12 mm (1/2 inch) of finished wall surface unless otherwise indicated.
6. Bridging: Provide horizontal or diagonal type bridging for joists and joist girders, complying with STEEL JOIST INSTITUTE specifications. Provide bridging anchors for ends of bridging lines terminating at walls or beams. Provide bridging adequate to resist the loads indicated on the Contract Documents.
7. End Anchorage: Provide end anchorages, including bearing plates, to secure joists to adjacent construction, complying with STEEL JOIST INSTITUTE specifications, unless otherwise indicated. Design all end anchorages to resist a minimum net uplift of 1.6 kPa (35 pounds per square foot) of supported area.
8. Header Units: Provide header units to support all joists at openings in floor or roof system not framed with steel shapes.
9. Provide supplemental steel support framing for metal deck where normal deck bearing is precluded by other framing members and minor openings.

3.2 SHOP PAINTING:

- A. Shop painting in accordance with applicable STEEL JOIST INSTITUTE standard specification.
- B. Shop paint joists and accessories with a rust-inhibiting primer paint. For joists which will be finish painted, limit paint to a primer which is compatible with specified finish paint. In high humidity areas, shop paint joists with a zinc-rich primer to receive top coats per the paint system manufacturer's recommendations.

3.3 ERECTION:

- A. Installation of joists in accordance with applicable STEEL JOIST INSTITUTE standard specification.
- B. Handle joists in a manner to avoid damaging of joists. Remove damaged joists from site, except when field repair is approved and such repairs are satisfactorily made in accordance with manufacturer's recommendations.
- C. Accurately set joists and end anchorage in accordance with the applicable STEEL JOIST INSTITUTE standard specification. Secure joists resting on masonry or concrete bearing surfaces by welding or bolting to the steel bearing plates as indicated on the Contract Documents. Secure bridging and anchoring in place prior to application of any construction loads. Distribute any temporary loads so that carrying capacity of any joist is not exceeded. Loads shall not be applied to bridging where joist lengths are 12 m (40 feet) and longer. Where joist lengths are 12 m (40 feet) and longer, install a center row of bolted diagonal bridging to provide lateral stability before slackening of hoisting lines.

3.4 FIELD PAINTING:

- A. Clean abraded, corroded, and field welded areas and touch up with same type of paint used in shop painting.
- B. Finish painting of steel surfaces is specified in Section 09 91 00, PAINTING.

- - - E N D - - -

SECTION 05 31 00
STEEL DECKING

PART 1 - GENERAL

1.1 DESCRIPTION:

This section specifies material and services required for installation of steel decking as shown and specified.

1.2 RELATED WORK:

- A. Materials testing and inspection during construction: Section 01 45 29, TESTING LABORATORY SERVICES.
- B. Finish Painting: Section 09 91 00, PAINTING.

1.3 DESIGN REQUIREMENTS:

- A. Design steel decking in accordance with AISI publication, "Specification for the Design of Cold-formed Steel Structural Members" except as otherwise shown or specified.
- B. Design all elements with the latest published version of applicable codes.

1.4 SUBMITTALS:

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Shop Drawings: Shop and erection drawings showing decking unit layout, connections to supporting members, and similar information necessary for completing installation as shown and specified, including supplementary framing, sump pans, ridge and valley plates, cant strips, cut openings, special jointing or other accessories. Show welding, side lap, closure, deck reinforcing and closure reinforcing details. Show openings required for work of other trades, including openings not shown on structural drawings. Indicate where temporary shoring is required to satisfy design criteria.
- C. Manufacturer's Literature and Data: Showing steel decking section properties and specifying structural characteristics.
- D. Certification: For each type and gauge of metal deck supporting concrete slab or fill, furnish certification of the specified fire ratings. Certify that the units supplied are U.L. listed as a "Steel Floor and Form Unit".
- E. Insurance Certification: Assist the Government in preparation and submittal of roof installation acceptance certification as may be necessary in connection with fire and extended coverage insurance.

1.5 QUALITY ASSURANCE:

- A. Underwriters' Label: Provide metal floor deck units listed in Underwriters' Laboratories "Fire Resistance Directory", with each deck unit bearing the UL label and marking for specific system detailed.
- B. FM Listing: Provide metal roof deck units which have been evaluated by Factory Mutual Global and are listed in "Factory Mutual Research Approval Guide" for "Class 1" fire rated construction.

1.6 APPLICABLE PUBLICATIONS:

- A. Publications listed below form a part of this specification to extent referenced. Publications are referenced in text by basic designation only.
- B. American Society for Testing and Materials (ASTM):
 - A36/A36M-08 Standard Specification for Carbon Structural Steel
 - A611-97 Standard Specification for Structural Steel (SS), Sheet, Carbon, Cold-Rolled
 - A653/A653M-08 Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvanized) by the Hot-Dip Process
 - C423-08 Standard Test Method for Sound Absorption and Sound Absorption Coefficients by the Reverberation Room Method
- C. American Institute of Steel Construction (AISC):
 - 1. Specification for Structural Steel Buildings - Allowable Stress Design and Plastic Design (ninth Edition, 1989)
 - 2. Load and Resistance Factor Design Specification for Structural Steel Buildings (Latest Edition)
- D. American Iron and Steel Institute (AISI):
 - 1. Specification and Commentary for the Design of Cold-Formed Steel Structural Members
- E. American Welding Society (AWS):
 - D1.3-08 Structural Welding Code - Sheet Steel
- F. Factory Mutual (FM Global):
 - 1. Loss Prevention Data Sheet 1-28: Wind Loads to Roof Systems and Roof Deck Securement
 - 2. Factory Mutual Research Approval Guide (2002)
- G. Military Specifications (Mil. Spec.)
 - MIL-P-21035B Paint, High Zinc Dust Content, Galvanizing Repair

PART 2 - PRODUCTS**2.1 MATERIALS:**

- A. Steel Decking: ASTM A653, Structural Quality.
- B. Galvanizing: ASTM A653, G60.
- C. Galvanizing Repair Paint: Mil. Spec. MIL-P-21035B.
- D. Primer for Shop Painted Sheets: Manufacturer's standard primer (2 coats). When finish painting of steel decking is specified in Section 09 91 00, PAINTING primer coating shall be compatible with specified finish painting.
- E. Miscellaneous Steel Shapes: ASTM A36.
- F. Welding Electrode: E60XX minimum.
- G. Sheet Metal Accessories: ASTM A653, galvanized, unless noted otherwise. Provide accessories of every kind required to complete the installation of metal decking in the system shown. Finish sheet metal items to match deck including, but not limited to, the following items:
 - 1. Metal Cover Plates: For end-abutting deck units, to close gaps at changes in deck direction, columns, walls and openings. Same quality as deck units but not less than 1.3 mm (18 gauge) sheet steel.
 - 2. Continuous Sheet Metal Edging: At openings, concrete slab edges and roof deck edges. Same quality as deck units but not less than 1.3 mm (18 gauge) steel. Side and end closures supporting concrete and their attachment to supporting steel shall be designed by the manufacturer, unless specified on construction documents, to safely support the wet weight of concrete and construction loads. The deflection of cantilever closures shall be limited to 3 mm (1/8 inch) maximum.
 - 3. Metal Closure Strips: For openings between decking and other construction, of not less than 1.3 mm (18 gauge) sheet steel of the same quality as the deck units. Form to the configuration required to provide tight-fitting closures at open ends of flutes and of sides decking.
 - 4. Ridge and Valley Plates: Provide 1.3 mm (18 gauge), minimum 100 mm (4 inch) wide ridge and valley plates where roof slope exceeds 40 mm per meter (1/2 inch per foot).
 - 5. Cant Strips: Provide bent metal 45 degree leg cant strips where indicated on the Drawings. Fabricate cant strips from 1 mm (20 gauge) metal with a minimum 125 mm (5 inch) face width.
 - 6. Seat Angles for Deck: Provide where a beam does not frame into a column.

7. Sump Pans for Roof Drains: Fabricated from single piece of minimum 1.9 mm (14 gauge) galvanized sheet steel with level bottoms and sloping sides to direct water flow to drain, unless otherwise shown. Provide sump pans of adequate size to receive roof drains and with bearing flanges not less than 75 mm (3 inches) wide. Recess pans not less than 38 mm (1 1/2 inches) below roof deck surface, unless otherwise shown or required by deck configuration. Holes for drains will be cut in the field.

2.2 REQUIREMENTS:

- A. Provide steel decking of the type, depth, gauge, and section properties as shown.
- B. Metal Roof Deck: Single pan fluted units with flat horizontal top surfaces utilized to act as a permanent support for all superimposed loads. Comply with the depth and minimum gage requirements as shown on the Contract Documents.
 1. Wide Rib (Type B) deck.
 2. Finish: Galvanized G-60.
- C. Do not use steel deck for hanging supports for any type or kind of building components including suspended ceilings, electrical light fixtures, plumbing, heating, or air conditioning pipes or ducts or electrical conduits.

PART 3 - EXECUTION

3.1 ERECTION:

- A. Do not start installation of metal decking until corresponding steel framework has been plumbed, aligned and completed and until temporary shoring, where required, has been installed. Remove any oil, dirt, paint, ice, water and rust from steel surfaces to which metal decking will be welded.
- B. Coordinate and cooperate with structural steel erector in locating decking bundles to prevent overloading of structural members.
- C. Do not use deck units for storage or working platforms until permanently secured. Do not overload deck units once placed. Replace any deck units that become damaged after erection at no cost to the Government.
- D. Provide steel decking in sufficient lengths to extend over 3 or more spans, except for interstitial levels.
- E. Place steel decking units at right angles to supporting members. End laps of sheets of roof deck shall be a minimum of 50 mm (2 inches) and shall occur over supports.

F. Fastening Deck Units:

1. Fasten roof deck units to steel supporting members by not less than 16 mm (5/8 inch) diameter puddle welds or elongated welds of equal strength, spaced not more than 305 mm (12 inches) o.c. at every support, and at closer spacing where required for lateral force resistance by diaphragm action. Attach split or partial panels to the structure in every valley. In addition, secure deck to each supporting member in ribs where side laps occur. Power driven fasteners may be used in lieu of welding for roof deck if strength equivalent to the welding specified above is provided. Submit test data and design calculations verifying equivalent design strength.
2. Mechanically fasten side laps of adjacent roof deck units with spans greater than 1524 mm (5 feet) between supports, at intervals not exceeding 915 mm (3 feet) o.c., or midspan, whichever is closer, using self-tapping No. 8 or larger machine screws.
3. Provide any additional fastening necessary to comply with the requirements of Underwriters Laboratories and/or Factory Mutual to achieve the required ratings.
4. Uplift Loading: Install and anchor roof deck units to resist gross uplift loading of 2.1 kPa (45 psf) at eave overhang and 1.4 kPa (30 psf) for other roof areas, unless noted otherwise on contract documents.

G. Cutting and Fitting:

1. Cut all metal deck units to proper length in the shop prior to shipping.
2. Field cutting by the metal deck erector is restricted to bevel cuts, notching to fit around columns and similar items, and cutting openings that are located and dimensioned on the Structural Drawings.
3. Other penetrations shown on the approved metal deck shop drawings but not shown on the Structural Drawings are to be located, cut and reinforced by the trade requiring the opening.
4. Make all cuts neat and trim using a metal saw, drill or punchout device; cutting with torches is expressly prohibited.
5. Do not make any cuts in the metal deck that are not shown on the approved metal deck drawings. If an additional opening not shown on the approved shop drawings is required, submit a sketch, to scale, locating the required new opening and any other openings and supports in the immediate area. Do not cut the opening until the sketch has been reviewed and accepted by the Resident Engineer. Provide any additional reinforcing or framing required for the opening at no cost

to the Government. Failure to comply with these requirements is cause for rejection of the work and removal and replacement of the affected metal deck.

6. Reinforcement at Openings: Provide additional metal reinforcement and closure pieces as required for strength, continuity of decking, and support of other work shown.

3.2 WELDING:

Welds shall be made only by welders and welding operators who have been previously qualified by tests as prescribed in AWS D1.3.

3.3 FIELD REPAIR:

1. Areas scarred during erection.
2. Welds to be thoroughly cleaned and touched-up. Touch-up paint for zinc-coated units shall be zinc rich galvanizing repair paint. -

- - E N D - - -

SECTION 05 36 00
COMPOSITE METAL DECKING

PART 1 - GENERAL

1.1 DESCRIPTION:

This section specifies material and services required for installation of composite steel decking including miscellaneous closures required to prepare deck for concrete placement as shown and specified.

1.2 RELATED WORK:

Materials testing and inspection during construction: Section 01 45 29, TESTING LABORATORY SERVICES.

1.3 DESIGN REQUIREMENTS:

- A. Design steel decking in accordance with American Iron And Steel Institute publication "Specifications for the Design of Cold Formed Steel Structural Members", except as otherwise shown or specified.
- B. Design all elements with the latest published version of applicable codes.

1.4 SUBMITTALS:

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Shop Drawings: Shop and erection drawings showing decking unit layout, connections to supporting members, and information necessary to complete the installation as shown and specified, including supplementary framing, cant strips, cut openings, special jointing or other accessories. Show welding, side lap, closure, deck reinforcing and closure reinforcing details. Show openings required for work of other trades, including openings not shown on structural drawings. Indicate where temporary shoring is required to satisfy design criteria.
- C. Manufacturer's Literature and Data: Showing steel decking section properties and specifying structural characteristics as specified herein.
- D. Manufacturer's written recommendations for:
 - 1. Shape of decking section to be used.
 - 2. Cleaning of steel decking prior to concrete placement.
- E. Test Report - Establishing structural characteristics of composite concrete and steel decking system.
- F. Certification: For each type and gauge of metal deck supporting concrete slab or fill, furnish certification of the specified fire ratings. Certify that the units supplied are U.L. listed as a "Steel Floor and Form Unit".

1.5 QUALITY ASSURANCE:

- A. Underwriters' Label: Provide metal floor deck units listed in Underwriters' Laboratories "Fire Resistance Directory", with each deck unit bearing the UL label and marking for specific system

1.6 APPLICABLE PUBLICATIONS:

- A. Publications listed below form a part of this specification to extent referenced. Publications are referenced in text by basic designation only. Refer to the latest edition of all referenced Standards and codes.
- B. American Iron and Steel Institute (AISI):
Specification and Commentary for the Design of Cold-Formed Steel Structural Members (Latest Edition).
- C. American Society of Testing and Materials (ASTM):
A36/A36M Standard Specification for Carbon Structural Steel
A108 Standard Specification for Steel Bars, Carbon, Cold Finished, Standard Quality
A653/A653M Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvanized) by the Hot-Dip Process
- D. American Institute of Steel Construction (AISC):
1. Specification for Structural Steel Buildings - Allowable Stress Design and Plastic Design (Latest Edition)
2. Load and Resistance Factor Design Specification for Structural Steel Buildings (Latest Edition)
- E. American Welding Society (AWS):
D1.1 Structural Welding Code - Steel
D1.3 Structural Welding Code - Sheet Steel
- F. Military Specifications (Mil. Spec.):
MIL-P-21035B Paint, High Zinc Dust Content, Galvanizing Repair

PART 2 - PRODUCTS**2.1 MATERIALS:**

- A. Steel Decking and all Flashings: ASTM A653, Structural Quality.
- B. Galvanizing: ASTM A653 and G60.
- C. Galvanizing Repair Paint: Mil. Spec. MIL-P-21035B.
- D. Miscellaneous Steel Shapes: ASTM A36.
- E. Welding Electrode: E60XX minimum.

F. Sheet Metal Accessories: ASTM A653, galvanized, unless noted otherwise. Provide accessories of every kind required to complete the installation of metal decking in the system shown. Finish sheet metal items to match deck including, but not limited to, the following items:

1. Metal Cover Plates: For end-abutting deck units, to close gaps at changes in deck direction, columns, walls and openings. Same quality as deck units but not less than 1.3 mm (18 gauge) sheet steel.
2. Continuous sheet metal edging: at openings and concrete slab edges. Same quality as deck units but not less than 1.3 mm (18 gauge) steel. Side and end closures supporting concrete and their attachment to supporting steel shall be designed by the manufacturer to safely support the wet weight of concrete and construction loads. The deflection of cantilever closures shall be limited to 3 mm (1/8 inch) maximum.
3. Metal Closure Strips: For openings between decking and other construction, of not less than 1.3 mm (18 gauge) sheet steel of the same quality as the deck units. Form to the configuration required to provide tight-fitting closures at open ends of flutes and sides of decking.
4. Seat angles for deck: Where a beam does not frame into a column.

2.2 REQUIREMENTS:

- A. Steel decking depth, gage, and section properties to be as shown. Provide edges of deck with vertical interlocking male and female lip providing for a positive mechanical connection.
- B. Fabricate deck units with integral embossments to provide mechanical bond with concrete slab. In combination with concrete slab, capable of supporting total design loads on spans shown.
- C. Steel decking capable of safely supporting total, normal construction service loads without damage to decking unit.
- D. Steel decking units shall include an integral system which provides a simple point of attachment for light duty hanger devices for flexibility for attaching hangers for support of acoustical, lathing, plumbing, heating, air conditioning and electrical items. System shall provide for minimum spacing pattern of 300 mm (12 inches) on centers longitudinally and 600 mm or 900 mm (24 or 36 inches) on centers transversely. Suspension system shall be capable of safely supporting a maximum allowable load of 45 kg (100 pounds) concentrated at any one hanger attachment point. System may consist of fold-down type hanger tabs or a lip hanger.

PART 3 - EXECUTION**3.1 ERECTION:**

- A. Do not start installation of metal decking until corresponding steel framework has been plumbed, aligned and completed and until temporary shoring, where required, has been installed. Remove any oil, dirt, paint, ice, water and rust from steel surfaces to which metal decking will be welded.
- B. Coordinate and cooperate with structural steel erector in locating decking bundles to prevent overloading of structural members.
- C. Do not use floor deck units for storage or working platforms until permanently secured. Do not overload deck units once placed. Replace any deck units that become damaged after erection and prior to casting concrete at no cost to the Government.
- D. Erect steel deck in accordance with manufacturer's printed instructions.
- E. Ship steel deck units to project in standard widths and cut to proper length.
- F. Provide steel decking in sufficient lengths to extend over 3 or more spans, except where structural steel layout does not permit.
- G. Place steel decking units on supporting steel framework and adjust to final position before being permanently fastening. Bring each unit to proper bearing on supporting beams. Place deck units in straight alignment for entire length of run of flutes and with close registration of flutes of one unit with those of abutting unit. Maximum space between ends of abutting units is 13 mm (1/2 inch). If space exceeds 13 mm (1/2 inch), install closure plates at no additional cost to Government.
- H. Ceiling hanger loops, if used, must be flattened or removed to obtain bearing of units on structural steel.
- I. Fastening Deck Units:
 - 1. Fasten floor deck units to steel supporting members by not less than 16 mm (5/8 inch) diameter puddle welds or elongated welds of equal strength, spaced not more than 305 mm (12 inches) o.c. with a minimum of four welds per unit at each support. Where two units abut, fasten each unit individually to the supporting steel framework.
 - 2. Tack weld or use self-tapping No. 8 or larger machine screws at 915 mm (3 feet) o.c. for fastening end closures. Only use welds to attach longitudinal end closures.
 - 3. Weld side laps of adjacent floor deck units that span more than 1524 mm (5 feet). Fasten at midspan or 915 mm (3 feet) o.c., whichever is smaller.

- J. Welding to conform to AWS D1.3 and done by competent experienced welding mechanics.
- K. Areas scarred during erection and welds shall be thoroughly cleaned and touched-up with zinc rich galvanizing repair paint. Paint touch-up is not required for welds or scars that are to be in direct contact with concrete.
- L. Provide metal concrete stops at edges of deck as required.
- M. Cutting and Fitting:
1. Cut all metal deck units to proper length in the shop prior to shipping.
 2. Field cutting by the metal deck erector is restricted to bevel cuts, notching to fit around columns and similar items, and cutting openings that are located and dimensioned on the structural drawings.
 3. Other penetrations shown on the approved metal deck shop drawings but not shown on the structural drawings are to be located, cut and reinforced by the trade requiring the opening.
 4. Make all cuts neat and trim using a metal saw, drill or punchout device; cutting with torches is expressly prohibited.
 5. Do not make any cuts in the metal deck that are not shown on the approved metal deck drawings. If an additional opening not shown on the approved shop drawings is required, submit a sketch, to scale, locating the required new opening and any other openings and supports in the immediate area. Do not cut the opening until the sketch has been reviewed and accepted by the Resident Engineer. Provide any additional reinforcing or framing required for the opening at no cost to the Government. Failure to comply with these requirements is cause for rejection of the work and removal and replacement of the affected metal deck.
 6. Reinforcement at Openings: Provide additional metal reinforcement and closure pieces as required for strength, continuity of decking and support of other work shown.

3.2 CLEANING:

Clean deck in accordance with manufacturer's recommendation before concrete placement.

- - - E N D - - -

THIS PAGE INTENTIONALLY LEFT BLANK

SECTION 05 40 00
COLD-FORMED METAL FRAMING

PART 1 - GENERAL

1.1 DESCRIPTION:

A. This section specifies materials and services required for installation of cold-formed steel, including tracks and required accessories as shown and specified. This Section includes the following:

1. Exterior load-bearing steel stud walls.
2. Interior load-bearing steel stud walls.
3. Exterior non-load-bearing steel stud curtain wall.
4. Steel joists.
5. Steel trusses.

1.2 RELATED WORK:

- A. Structural steel framing: Section 05 12 00, STRUCTURAL STEEL FRAMING.
- B. Open web steel joists: Section 05 21 00, STEEL JOIST FRAMING.
- C. Non-load-bearing metal stud framing assemblies: Section 09 22 16, NON-STRUCTURAL METAL FRAMING.
- D. Gypsum board assemblies: Section 09 29 00, GYPSUM BOARD.

1.3 DESIGN REQUIREMENTS:

- A. Design steel in accordance with American Iron and Steel Institute Publication "Specification for the Design of Cold-Formed Steel Structural Members", except as otherwise shown or specified.
- B. Structural Performance: Engineer, fabricate and erect cold-formed metal framing with the minimum physical and structural properties indicated.

1.4 SUBMITTALS:

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Shop Drawings: Shop and erection drawings showing steel unit layout, connections to supporting members, and information necessary to complete installation as shown and specified.
- C. Manufacturer's Literature and Data: Showing steel component sections and specifying structural characteristics.

1.5 APPLICABLE PUBLICATIONS:

- A. Publications listed below form a part of this specification to extent referenced. Publications are referenced in text by basic designation only.

- B. American Iron and Steel Institute (AISI):
 Specification and Commentary for the Design of Cold-Formed Steel
 Structural Members (1996)
- C. American Society of Testing and Materials (ASTM):
 A36/A36M(REV. A)-2003 ..Standard Specifications for Carbon Structural
 Steel
 A123/A123M-2002 Standard Specifications for Zinc (Hot-Dip
 Galvanized) Coatings on Iron and Steel Products
 A153/A153M-2003 Standard Specifications for Zinc Coating (Hot-
 Dip) on Iron and Steel Hardware
 A307-2002 Standard Specifications for Carbon Steel Bolts
 and Studs
 A653/A653M-2003 Standard Specifications for Steel Sheet, Zinc-
 Coated (Galvanized) or Zinc-Iron Alloy-Coated
 (Galvannealed) by the Hot-Dip Process
 C955-2003 Standard Specifications for Load-Bearing
 (Transverse and Axial) Steel Studs, Runners
 (Tracks), and Bracing or Bridging for Screw
 Application of Gypsum Panel Products and Metal
 Plaster Bases
 C1107-2002 Standard Specifications for Packaged Dry,
 Hydraulic-Cement Grout (Non-shrink)
 E488-96(Reapproved 2003)Standard Test Methods for Strength of
 Anchors in Concrete and Masonry Elements
 E1190-95(Reapproved 2000)Standard Test Methods for Strength of
 Power-Actuated Fasteners Installed in
 Structural Members
- D. American Welding Society (AWS):
 D1.3-(98) Structural Welding Code-Sheet Steel
- E. Military Specifications (Mil. Spec.):
 MIL-P-21035B(Reinst. Notice 2) Paint, High Zinc Dust Content,
 Galvanizing Repair

PART 2 - PRODUCTS

2.1 MATERIALS:

- A. Sheet Steel for joists, studs and accessories 16 gage and heavier: ASTM
 A653, structural steel, zinc coated G60, with a yield of 340 MPa (50
 ksi) minimum.

B. Sheet Steel for joists, studs and accessories 18 gage and lighter:
ASTM A653, structural steel, zinc coated G60, with a yield of 230 MPa
(33 ksi) minimum.

C. Galvanizing Repair Paint: MIL-P-

21035B. 2.2 WALL FRAMING:

A. Steel Studs: Manufacturer's standard C-shaped steel studs of web depth indicated, with lipped flanges, and complying with the following:

1. Design Uncoated-Steel Thickness: As indicated, or thicker.
2. Flange Width: As indicated or wider.
3. Web: Punched.

B. Steel Track: Manufacturer's standard U-shaped steel track, unpunched, of web depths indicated, with straight flanges, and complying with the following:

1. Design Uncoated-Steel Thickness: Matching steel studs, unless noted otherwise.
2. Flange Width: Manufacturer's standard deep flange where indicated, standard flange elsewhere.

2.3 JOIST FRAMING:

A. Steel Joists: Manufacturer's standard C-shaped steel joists, unpunched, of web depths indicated, with lipped flanges, and complying with the following:

1. Design Uncoated-Steel Thickness: As indicated, or thicker.
2. Flange Width: As indicated, or wider.

B. Steel Joist Track: Manufacturer's standard U-shaped steel joist track, unpunched, of web depths indicated, with straight flanges, and complying with the following:

1. Design Uncoated-Steel Thickness: Matching steel joists, unless noted otherwise.
2. Flange Width: As indicated or

wider. 2.4 FRAMING ACCESSORIES:

A. Fabricate steel framing accessories of the same material and finish used for framing members, with a minimum yield strength of 230 MPa (33 ksi).

B. Provide accessories of manufacturer's standard thickness and configuration, unless otherwise indicated, as follows:

1. Supplementary framing.
2. Bracing, bridging, and solid blocking.
3. Web stiffeners.

4. Gusset plates.
5. Deflection track and vertical slide clips.
6. Stud kickers and girts.
7. Joist hangers and end closures.
8. Reinforcement plates. 2.5

ANCHORS, CLIPS, AND FASTENERS:

- A. Steel Shapes and Clips: ASTM A36, zinc coated by the hot-dip process according to ASTM A123.
- B. Cast-in-Place Anchor Bolts and Studs: ASTM A307, Grade A, zinc coated by the hot-dip process according to ASTM A153.
- C. Expansion Anchors: Fabricated from corrosion-resistant materials, with capability to sustain, without failure, a load equal to 5 times the design load, as determined by testing per ASTM E488 conducted by a qualified independent testing agency.
- D. Power-Actuated Anchors: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with capability to sustain, without failure, a load equal to 10 times the design load, as determined by testing per ASTM E1190 conducted by a qualified independent testing agency.
- E. Mechanical Fasteners: Corrosion-resistant coated, self-drilling, self-threading steel drill screws. Low-profile head beneath sheathing, manufacturer's standard elsewhere.

2.6 REQUIREMENTS:

- A. Welding in accordance with AWS D1.3
- B. Furnish members and accessories by one manufacturer

only. PART 3 - EXECUTION

3.1 FABRICATION:

- A. Framing components may be preassembled into panels. Panels shall be square with components attached.
- B. Cut framing components squarely or as required for attachment. Cut framing members by sawing or shearing; do not torch cut.
- C. Hold members in place until fastened.
- D. Fasten cold-formed metal framing members by welding or screw fastening, as standard with fabricator. Wire tying of framing members is not permitted.
 1. Comply with AWS requirements and procedures for welding, appearance and quality of welds, and methods used in correcting welding work.

2. Locate mechanical fasteners and install according to cold-formed metal framing manufacturer's instructions with screw penetrating joined members by not less than 3 exposed screw threads.

E. Where required, provide specified insulation in double header members and double jamb studs which will not be accessible after erection. **3.2 ERECTION:**

- A. Handle and lift prefabricated panels in a manner as to not distort any member.
- B. Securely anchor tracks to supports as shown.
- C. At butt joints, securely anchor two pieces of track to same supporting member or butt-weld or splice together.
- D. Plumb, align, and securely attach studs to flanges or webs of both upper and lower tracks.
- E. All axially loaded members shall be aligned vertically to allow for full transfer of the loads down to the foundation. Vertical alignment shall be maintained at floor/wall intersections.
- F. Install jack studs above and below openings and as required to furnish support. Securely attach jack studs to supporting members.
- G. Install headers in all openings that are larger than the stud spacing in that wall.
- H. Attach bridging for studs in a manner to prevent stud rotation. Space bridging rows as shown.
- I. Studs in one piece for their entire length, splices will not be permitted.
- J. Provide a load distribution member at top track where joist is not located directly over bearing stud.
- K. Provide joist bridging and web stiffeners at reaction points where shown.
- L. Provide end blocking where joist ends are not restrained from rotation.
- M. Provide an additional joist under parallel partitions, unless otherwise shown, when partition length exceeds one-half joist span and when floor and roof openings interrupt one or more spanning members.
- N. Provide temporary bracing and leave in place until framing is permanently stabilized.
- O. Do not bridge building expansion joints with cold-formed metal framing. Independently frame both sides of joints.
- P. Fasten reinforcement plate over web penetrations that exceed size of manufacturer's standard punched openings.

3.3 TOLERANCES:

- A. Vertical alignment (plumbness) of studs shall be within 1/960th of the span.
- B. Horizontal alignment (levelness) of walls shall be within 1/960th of their respective lengths.
- C. Spacing of studs shall not be more than 3 mm (1/8 inch) +/- from the designed spacing providing that the cumulative error does not exceed the requirements of the finishing materials.
- D. Prefabricated panels shall be not more than 3 mm (1/8 inch) +/- out of square within the length of that panel.

3.4 FIELD REPAIR:

Touch-up damaged galvanizing with galvanizing repair paint.

- - - E N D - - -

SECTION 05 50 00
METAL FABRICATIONS

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This section specifies items and assemblies fabricated from structural steel shapes and other materials as shown and specified.
- B. Items specified.
 - 1. Support for Wall and Ceiling Mounted Items
 - 2. Frames
 - 3. Guards
 - 4. Aluminum Cornices
 - 5. Gratings
 - 6. Loose Lintels
 - 7. Shelf Angles
 - 8. Railings

1.2 RELATED WORK

- A. Railings attached to steel stairs: Section 05 51 00, METAL STAIRS.
- B. Prime and finish painting: Section 09 91 00, PAINTING.
- C. Stainless steel corner guards: Section 10 26 00, WALL AND DOOR PROTECTION.

1.3 SUBMITTALS

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Manufacturer's Literature and Data:
 - 1. Grating, each type
 - 2. Cornices
 - 3. Guards
 - 4. Railings
- C. Shop Drawings:
 - 1. Each item specified, showing complete detail, location in the project, material and size of components, method of joining various components and assemblies, finish, and location, size and type of anchors.
 - 2. Mark items requiring field assembly for erection identification and furnish erection drawings and instructions.
 - 3. Provide templates and rough-in measurements as required.
- D. Manufacturer's Certificates:
 - 1. Anodized finish as specified.
 - 2. Live load designs as specified.

E. Furnish setting drawings and instructions for installation of anchors to be preset into concrete and masonry work, and for the positioning of items having anchors to be built into concrete or masonry construction. 1.4

QUALITY ASSURANCE

- A. Each manufactured product shall meet, as a minimum, the requirements specified, and shall be a standard commercial product of a manufacturer regularly presently manufacturing items of type specified.
- B. Each product type shall be the same and be made by the same manufacturer.
- C. Assemble product to the greatest extent possible before delivery to the site.
- D. Include additional features, which are not specifically prohibited by this specification, but which are a part of the manufacturer's standard commercial product.

1.5 APPLICABLE PUBLICATIONS

- A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.
- B. American Society of Mechanical Engineers (ASME):
 - B18.6.1-81(R1997) Wood Screws
 - B18.2.2-87(R2005) Square and Hex Nuts
- C. American Society for Testing and Materials (ASTM):
 - A36/A36M-05 Structural Steel
 - A47-99(R2004) Malleable Iron Castings
 - A48-03 Gray Iron Castings
 - A53-06 Pipe, Steel, Black and Hot-Dipped, Zinc-Coated
Welded and Seamless
 - A123-02 Zinc (Hot-Dip Galvanized) Coatings on Iron and
Steel Products
 - A167-99(R2004) Stainless and Heat-Resisting Chromium-Nickel
Steel Plate, Sheet and Strip
 - A269-07 Seamless and Welded Austenitic Stainless Steel
Tubing for General Service
 - A307-07 Carbon Steel Bolts and Studs, 60,000 PSI Tensile
Strength
 - A312/A312M-06 Seamless, Welded, and Heavily Cold Worked
Austenitic Stainless Steel Pipes
 - A391/A391M-01 Grade 80 Alloy Steel Chain

- A653/A653M-07Steel Sheet, Zinc Coated (Galvanized) or Zinc-Iron Alloy Coated (Galvannealed) by the Hot-Dip Process
- A786/A786M-05Rolled Steel Floor Plate
- B221-06 Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Shapes, and Tubes
- B456-03Electrodeposited Coatings of Copper Plus Nickel Plus Chromium and Nickel Plus Chromium
- B632-02Aluminum-Alloy Rolled Tread Plate
- C1107-07 Packaged Dry, Hydraulic-Cement Grout (Nonshrink)
- D3656-04 Insect Screening and Louver Cloth Woven from Vinyl-Coated Glass Yarns
- F436-07Hardened Steel Washers
- F468-06Nonferrous Bolts, Hex Cap Screws, and Studs for General Use
- F593-02 Stainless Steel Bolts, Hex Cap Screws, and Studs
- F1667-05Driven Fasteners: Nails, Spikes and Staples
- D. American Welding Society (AWS):
- D1.1-04 Structural Welding Code Steel
- D1.2-03 Structural Welding Code Aluminum
- D1.3-98 Structural Welding Code Sheet Steel
- E. National Association of Architectural Metal Manufacturers (NAAMM)
- AMP521-01Pipe Railing Manual
- AMP 500-505-1988Metal Finishes Manual
- MBG 531-00Metal Bar Grating Manual
- MBG 532-00Heavy Duty Metal Bar Grating Manual
- F. Structural Steel Painting Council
- SP 1-05 .. No. 1, Solvent Cleaning
- SP 2-05 .. No. 2, Hand Tool Cleaning
- SP 3-05 .. No. 3, Power Tool Cleaning
- G. Federal Specifications (Fed. Spec):
- RR-T-650E Treads, Metallic and Nonmetallic, Nonskid

PART 2 - PRODUCTS

2.1 DESIGN CRITERIA

- A. In addition to the dead loads, design fabrications to support the following live loads unless otherwise specified.
- B. Ladders and Rungs: 120 kg (250 pounds) at any point.
- C. Railings and Handrails: 900 N (200 pounds) in any direction at any point.

- D. Gratings: 500 kg/m² (100 pounds per square foot). Use 144 kg (300 pounds) for concentrated loads.

2.2 MATERIALS

- A. Structural Steel: ASTM A36.
- B. Stainless Steel: ASTM A167, Type 302 or 304.
- C. Steel Pipe: ASTM A53.
1. Galvanized for exterior locations.
 2. Type S, Grade A unless specified otherwise.
 3. NPS (inside diameter) as shown.
- D. Primer Paint: As specified in Section 09 91 00, PAINTING.
- E. Stainless Steel Tubing: ASTM A269, type 302 or 304.
- F. Modular Channel Units:
1. Factory fabricated, channel shaped, cold formed sheet steel shapes, complete with fittings bolts and nuts required for assembly.
 2. Form channel with in turned pyramid shaped clamping ridges on each side.
 3. Provide case hardened steel nuts with serrated grooves in the top edges designed to be inserted in the channel at any point and be given a quarter turn so as to engage the channel clamping ridges. Provide each nut with a spring designed to hold the nut in place.
 4. Factory finish channels and parts with oven baked primer when exposed to view. Channels fabricated of ASTM A525, G90 galvanized steel may have primer omitted in concealed locations. Finish screws and nuts with zinc coating.
 5. Fabricate snap-in closure plates to fit and close exposed channel openings of not more than 0.3 mm (0.0125 inch) thick stainless steel.
- G. Grout: ASTM C1107, pourable type.
- H. Insect Screening: ASTM D3656.

2.3 HARDWARE

- A. Rough Hardware:
1. Furnish rough hardware with a standard plating, applied after punching, forming and assembly of parts; galvanized, cadmium plated, or zinc-coated by electro-galvanizing process. Galvanized G-90 where specified.
 2. Use G90 galvanized coating on ferrous metal for exterior work unless non-ferrous metal or stainless is used.

B. Fasteners:

1. Bolts with Nuts:
 - a. ASME B18.2.2.
 - b. ASTM A307 for 415 MPa (60,000 psi) tensile strength bolts.
 - c. ASTM F468 for nonferrous bolts.
 - d. ASTM F593 for stainless steel.
2. Screws: ASME B18.6.1.
3. Washers: ASTM F436, type to suit material and anchorage.
4. Nails: ASTM F1667, Type I, style 6 or 14 for finish

work. 2.4 FABRICATION GENERAL**A. Material**

1. Use material as specified. Use material of commercial quality and suitable for intended purpose for material that is not named or its standard of quality not specified.
2. Use material free of defects which could affect the appearance or service ability of the finished product.

B. Size:

1. Size and thickness of members as shown.
2. When size and thickness is not specified or shown for an individual part, use size and thickness not less than that used for the same component on similar standard commercial items or in accordance with established shop methods.

C. Connections

1. Except as otherwise specified, connections may be made by welding, riveting or bolting.
2. Field riveting will not be approved.
3. Design size, number and placement of fasteners, to develop a joint strength of not less than the design value.
4. Holes, for rivets and bolts: Accurately punched or drilled and burrs removed.
5. Size and shape welds to develop the full design strength of the parts connected by welds and to transmit imposed stresses without permanent deformation or failure when subject to service loadings.
6. Use Rivets and bolts of material selected to prevent corrosion (electrolysis) at bimetallic contacts. Plated or coated material will not be approved.
7. Use stainless steel connectors for removable members machine screws or bolts.

D. Fasteners and Anchors

1. Use methods for fastening or anchoring metal fabrications to building construction as shown or specified.
2. Where fasteners and anchors are not shown, design the type, size, location and spacing to resist the loads imposed without deformation of the members or causing failure of the anchor or fastener, and suit the sequence of installation.
3. Use material and finish of the fasteners compatible with the kinds of materials which are fastened together and their location in the finished work.
4. Fasteners for securing metal fabrications to new construction only, may be by use of internally threaded inserts or wedge type inserts or by anchors for welding to the metal fabrication for installation before the concrete is placed or as masonry is laid.
5. Fasteners for securing metal fabrication to existing construction or new construction may be expansion bolts, toggle bolts, power actuated drive pins, welding, self drilling and tapping screws or bolts.

E. Workmanship

1. General:
 - a. Fabricate items to design shown.
 - b. Furnish members in longest lengths commercially available within the limits shown and specified.
 - c. Fabricate straight, true, free from warp and twist, and where applicable square and in same plane.
 - d. Provide holes, sinkages and reinforcement shown and required for fasteners and anchorage items.
 - e. Provide openings, cut-outs, and tapped holes for attachment and clearances required for work of other trades.
 - f. Prepare members for the installation and fitting of hardware.
 - g. Cut openings in gratings and floor plates for the passage of ducts, sumps, pipes, conduits and similar items. Provide reinforcement to support cut edges.
 - h. Fabricate surfaces and edges free from sharp edges, burrs and projections which may cause injury.
2. Welding:
 - a. Weld in accordance with AWS.
 - b. Welds shall show good fusion, be free from cracks and porosity and accomplish secure and rigid joints in proper alignment.

- c. Where exposed in the finished work, continuous weld for the full length of the members joined and have depressed areas filled and protruding welds finished smooth and flush with adjacent surfaces.
 - d. Finish welded joints to match finish of adjacent surface.
3. Joining:
- a. Miter or butt members at corners.
 - b. Where frames members are butted at corners, cut leg of frame member perpendicular to surface, as required for clearance.
4. Anchors:
- a. Where metal fabrications are shown to be preset in concrete, weld 32 x 3 mm (1-1/4 by 1/8 inch) steel strap anchors, 150 mm (6 inches) long with 25 mm (one inch) hooked end, to back of member at 600 mm (2 feet) on center, unless otherwise shown.
 - b. Where metal fabrications are shown to be built into masonry use 32 x 3 mm (1-1/4 by 1/8 inch) steel strap anchors, 250 mm (10 inches) long with 50 mm (2 inch) hooked end, welded to back of member at 600 mm (2 feet) on center, unless otherwise shown.
5. Cutting and Fitting:
- a. Accurately cut, machine and fit joints, corners, copes, and miters.
 - b. Fit removable members to be easily removed.
 - c. Design and construct field connections in the most practical place for appearance and ease of installation.
 - d. Fit pieces together as required.
 - e. Fabricate connections for ease of assembly and disassembly without use of special tools.
 - f. Joints firm when assembled.
 - g. Conceal joining, fitting and welding on exposed work as far as practical.
 - h. Do not show rivets and screws prominently on the exposed face.
 - i. The fit of components and the alignment of holes shall eliminate the need to modify component or to use exceptional force in the assembly of item and eliminate the need to use other than common tools.
- F. Finish:
- 1. Finish exposed surfaces in accordance with NAAMM Metal Finishes Manual.
 - 2. Steel and Iron: NAAMM AMP 504.
 - a. Zinc coated (Galvanized): ASTM A123, G90 unless noted otherwise.
 - b. Surfaces exposed in the finished work:

- 1) Finish smooth rough surfaces and remove projections.
- 2) Fill holes, dents and similar voids and depressions with epoxy type patching compound.

c. Shop Prime Painting:

- 1) Surfaces of Ferrous metal:
 - a) Items not specified to have other coatings.
 - b) Galvanized surfaces specified to have prime paint.
 - c) Remove all loose mill scale, rust, and paint, by hand or power tool cleaning as defined in SSPC-SP2 and SP3.
 - d) Clean of oil, grease, soil and other detrimental matter by use of solvents or cleaning compounds as defined in SSPC-SP1.
 - e) After cleaning and finishing apply one coat of primer as specified in Section 09 91 00, PAINTING.

2) Non ferrous metals: Comply with MAAMM-500 series.

3. Stainless Steel: NAAMM AMP-504 Finish No. 4.

4. Chromium Plating: ASTM B456, satin or bright as specified, Service Condition No. SC2.

G. Protection:

1. Insulate aluminum surfaces that will come in contact with concrete, masonry, plaster, or metals other than stainless steel, zinc or white bronze by giving a coat of heavy-bodied alkali resisting bituminous paint or other approved paint in shop.
2. Spot prime all abraded and damaged areas of zinc coating which expose the bare metal, using zinc rich paint on hot-dip zinc coat items and zinc dust primer on all other zinc coated items.

2.5 SUPPORTS

A. General:

1. Fabricate ASTM A36 structural steel shapes as shown.
2. Use clip angles or make provisions for welding hangers and braces to overhead construction.
3. Field connections may be welded or bolted.

B. For Wall Mounted Items:

1. For items supported by metal stud partitions.
2. Steel strip or hat channel minimum of 1.5 mm (0.0598 inch) thick.
3. Steel strip minimum of 150 mm (6 inches) wide, length extending one stud space beyond end of item supported.
4. Steel hat channels where shown. Flange cut and flattened for anchorage to stud.

5. Structural steel tube or channel for grab bar at water closets floor to structure above with clip angles or end plates formed for anchors.
6. Use steel angles for thru wall counters. Drill angle for fasteners at ends and not over 100 mm (4 inches) on center between ends.

C. For Cubical Curtain Track:

1. Fabricate assembly of steel angle as shown.
2. Drill angle bent ends for anchor screws to acoustical suspension system and angle for hanger wires.
3. Provide pipe sleeve welded to angle.

D. Supports for Overhead Lift, Accordion Partition Tracks, Exercise Equipment, and Items at Various Conditions at Suspended Ceilings:

1. Fabricate of structural steel shapes as shown.
2. Drill for anchor bolts of suspended

item. **2.6 FRAMES**

A. Elevator Entrance Wall Opening.

1. Fabricate of channel shapes, plates, and angles as shown.
2. Weld or bolt head to jamb as shown.
3. Weld clip angles to bottom of frame and top of jamb members extended to structure above for framed construction.
 - a. Provide holes for anchors.
 - b. Weld head to jamb members.

2.7 EXTRUDED ALUMINUM CORNICE

- A. Basis-of-Design: Perimeter Systems - Designer Series Formed Aluminum Cornice. Cornice Design 4 and Decorative Trims.
- B. Provide labor, material and equipment necessary for furnishing a complete installation of formed aluminum cornice.
- C. Submit manufacturer's product data and shop drawings showing fabrication and installation of cornice.
- D. Finish and Color: Furnish manufacturer's technical data for specified finish and color chart showing full range of colors available.
- E. Support Brackets, Attachment Brackets and Retainer Brackets shall be manufactured from 0.125" x 1.00" extruded aluminum bar, hellicarc welded construction (whole necessary) factory punched for fasteners.

2.8 GRATINGS

- A. Fabricate gratings to support live loads specified and a concentrated load as specified.
- B. Provide clearance at all sides to permit easy removal of grating.
- C. Fabricate sections of grating with end-banding bars.

- D. Fabricate angle frames and supports, including anchorage as shown.
 1. Fabricate intermediate supporting members from "T's" or angles.
 2. Locate anchors at ends and not over 600 mm (24 inches) o.c.
 3. Butt or miter, and weld angle frame at corners.

- E. Steel Bar Gratings:

1. Fabricate grating using steel bars, frames, supports and other members shown in accordance with Metal Bar Grating Manual.
2. Galvanize steel members after fabrication in accordance with ASTM A123, G-90 for exterior gratings, gratings in concrete floors, and interior grating where specified.
3. Interior gratings: Prime paint unless specified

galvanized. **2.9 LOOSE LINTELS**

- A. Furnish lintels of sizes shown. Where size of lintels is not shown, provide the sizes specified.
- B. Fabricate lintels with not less than 150 mm (6 inch) bearing at each end for nonbearing masonry walls, and 200 mm (8 inch) bearing at each end for bearing walls.
- C. Provide one angle lintel for each 100 mm (4 inches) of masonry thickness as follows except as otherwise specified or shown.
 1. Openings 750 mm to 1800 mm (2-1/2 feet to 6 feet) - 100 x 90 x 8 mm (4 x 3-1/2 x 5/16 inch).
 2. Openings 1800 mm to 3000 mm (6 feet to 10 feet) - 150 x 90 x 9 mm (6 x 3-1/2 x 3/8 inch).
- D. For 150 mm (6 inch) thick masonry openings 750 mm to 3000 mm (2-1/2 feet to 10 feet) use one angle 150 x 90 x 9 mm (6 x 3-1/2 x 3/8 inch).
- E. Provide bearing plates for lintels where shown.
- F. Weld or bolt upstanding legs of double angle lintels together with 19 mm (3/4 inch bolts) spaced at 300 mm (12 inches) on centers.
- G. Insert spreaders at bolt points to separate the angles for insertion of metal windows, louver, and other anchorage.
- H. Where shown or specified, punch upstanding legs of single lintels to suit size and spacing of anchor bolts.
- I. Elevator Entrance:
 1. Fabricate lintel from plate bent to channel shape, and provide a minimum of 100 mm (4 inch) bearing each end.
 2. Cut away the front leg of the channel at each end to allow for concealment behind elevator hoistway entrance frame.

2.10 SHELF ANGLES

- A. Fabricate from steel angles of size shown.

- B. Fabricate angles with horizontal slotted holes for 19 mm (3/4 inch) bolts spaced at not over 900 mm (3 feet) on centers and within 300 mm (12 inches) of ends.

2.11 RAILINGS

- A. In addition to the dead load design railing assembly to support live load specified.
- B. Fabrication General:
 - 1. Provide continuous welded joints, dressed smooth and flush.
 - 2. Standard flush fittings, designed to be welded, may be used.
 - 3. Exposed threads will not be approved.
 - 4. Form handrail brackets to size and design shown.
 - 5. Exterior Post Anchors.
 - a. Fabricate tube or pipe sleeves with closed ends or plates as shown.
 - b. Where inserts interfere with reinforcing bars, provide flanged fittings welded or threaded to posts for securing to concrete with expansion bolts.
 - c. Provide heavy pattern sliding flange base plate with set screws at base of pipe or tube posts.
 - 6. Interior Post Anchors:
 - a. Provide flanged fittings for securing fixed posts to floor with expansion bolts, unless shown otherwise.
 - b. Weld or thread flanged fitting to posts at base.
 - c. For securing removable posts to floor, provide close fitting sleeve insert or inverted flange base plate with stud bolts or rivets concrete anchor welded to the base plate.
 - d. Provide sliding flange base plate on posts secured with set screws.
 - e. Weld flange base plate to removable posts set in sleeves.
- C. Handrails:
 - 1. Close free ends of rail with flush metal caps welded in place except where flanges for securing to walls with bolts are shown.
 - 2. Make provisions for attaching handrail brackets to wall, posts, and handrail as shown.
- D. Steel Pipe Railings:
 - 1. Fabricate of steel pipe with welded joints.
 - 2. Number and space of rails as shown.
 - 3. Space posts for railings not over 1800 mm (6 feet) on centers between end posts.

4. Form handrail brackets from malleable iron.
5. Fabricate removable sections with posts at end of section.
6. Opening Guard Rails:
 - a. Fabricate rails with flanged fitting at each end to fit between wall opening jambs.
 - b. Design flange fittings for fastening with machine screws to steel plate anchored to jambs.
 - c. Fabricate rails for floor openings for anchorage in sleeves.
7. Gates:
 - a. Fabricate from steel pipe as specified for railings.
 - b. Fabricate gate fittings from either malleable iron or wrought steel.
 - c. Hang each gate on suitable spring hinges of clamp on or through bolted type. Use bronze hinges for exterior gates.
 - d. Provide suitable stops, so that gate will swing as shown.
 - e. Provide padlock eyes where

shown. PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

- A. Set work accurately, in alignment and where shown, plumb, level, free of rack and twist, and set parallel or perpendicular as required to line and plane of surface.
- B. Items set into concrete or masonry.
 1. Provide temporary bracing for such items until concrete or masonry is set.
 2. Place in accordance with setting drawings and instructions.
 3. Build strap anchors, into masonry as work progresses.
- C. Set frames of gratings, covers, corner guards, trap doors and similar items flush with finish floor or wall surface and, where applicable, flush with side of opening.
- D. Field weld in accordance with AWS.
 1. Design and finish as specified for shop welding.
 2. Use continuous weld unless specified otherwise.
- E. Install anchoring devices and fasteners as shown and as necessary for securing metal fabrications to building construction as specified. Power actuated drive pins may be used except for removable items and where members would be deformed or substrate damaged by their use.
- F. Spot prime all abraded and damaged areas of zinc coating as specified and all abraded and damaged areas of shop prime coat with same kind of paint used for shop priming.

G. Isolate aluminum from dissimilar metals and from contact with concrete and masonry materials as required to prevent electrolysis and corrosion.

H. Secure escutcheon plate with set

screw. 3.2 INSTALLATION OF SUPPORTS

A. Anchorage to structure.

1. Secure angles or channels and clips to overhead structural steel by continuous welding unless bolting is shown.
2. Secure supports to concrete inserts by bolting or continuous welding as shown.
3. Secure steel plate or hat channels to studs as detailed.

B. Supports for Wall Mounted items:

1. Locate center of support at anchorage point of supported item.
2. Locate support at top and bottom of wall hung cabinets.
3. Locate support at top of floor cabinets and shelving installed against walls.
4. Locate supports where required for items shown.

C. Supports for Cubicle Curtain Track:

1. Install assembly where shown after ceiling suspension grid is installed.
2. Drill angle for bolt and weld nut to angle prior to installation of tile.

D. Support for cantilever grab bars:

1. Locate channels or tube in partition for support as shown, and extend full height from floor to underside of structural slab above.
2. Anchor at top and bottom with angle clips bolted to channels or tube with two, 9 mm (3/8 inch) diameter bolts.
3. Anchor to floors and overhead construction with two 9 mm (3/8 inch) diameter bolts.
4. Fasten clips to concrete with expansion bolts, and to steel with machine bolts or welds.

3.3 DOOR FRAMES

A. Secure clip angles at bottom of frames to concrete slab with expansion bolts as shown.

B. Level and plumb frame; brace in position required.

C. At masonry, set frames in walls so anchors are built-in as the work progresses unless shown otherwise.

D. Set frames in formwork for frames cast into concrete.

E. Where frames are set in prepared openings, bolt to wall with spacers and expansion bolts.

3.4 OTHER FRAMES

- A. Set frame flush with surface unless shown otherwise.
- B. Anchor frames at ends and not over 450 mm (18 inches) on centers unless shown otherwise.
- C. Set in formwork before concrete is

placed. 3.5 GUARDS

- A. Steel Angle Corner Guards:
 - 1. Build into masonry as the work progress.
 - 2. Set into formwork before concrete is placed.
 - 3. Set angles flush with edge of opening and finish floor or wall or as shown.
 - 4. At existing construction fasten angle and filler piece to adjoining construction with 16 mm (5/8 inch) diameter by 75 mm (3 inch) long expansion bolts 450 mm (18 inches) on center.
 - 5. Install Guard Angles at Edges of Stairwell and Overhead Doors where shown.

3.6 GRATINGS

- A. Set grating flush with finish floor; top of curb, or areaway wall. Set frame so that horizontal leg of angle frame is flush with face of wall except when frame is installed on face of wall.
- B. Set frame in formwork before concrete is placed.
- C. Where grating terminates at a wall bolt frame to concrete or masonry with expansion bolts unless shown otherwise.
- D. Secure removable supporting members in place with stainless steel bolts.
- E. Bolt gratings to supports.

3.7 STEEL LINTELS

- A. Use lintel sizes and combinations shown or specified.
- B. Install lintels with longest leg upstanding, except for openings in 150 mm (6 inch) masonry walls install lintels with longest leg horizontal.
- C. Install lintels to have not less than 150 mm (6 inch) bearing at each end for nonbearing walls, and 200 mm (8 inch) bearing at each end for bearing walls.

3.8 SHELF ANGLES

- A. Anchor shelf angles with 19 mm (3/4 inch) bolts unless shown otherwise in adjustable malleable iron inserts, set level at elevation shown.
- B. Provide expansion space at end of members.

3.9 RAILINGS

A. Steel Posts:

1. Secure fixed posts to concrete with expansion bolts through flanged fittings except where sleeves are shown with pourable grout.
2. Install sleeves in concrete formwork.
3. Set post in sleeve and pour grout to surface. Apply beveled bead of urethane sealant at perimeter of post or under flange fitting as specified in Section 07 92 00, JOINT SEALANTS on exterior posts.
4. Secure removable posts to concrete with either machine screws through flanged fittings which are secured to inverted flanges embedded in and set flush with finished floor, or set posts in close fitting pipe sleeves without grout.
5. Secure sliding flanged fittings to posts at base with set screws.
6. Secure fixed flanged fittings to concrete with expansion bolts.
7. Secure posts to steel with welds.

B. Anchor to Walls:

1. Anchor rails to concrete or solid masonry with machine screws through flanged fitting to steel plate.
 - a. Anchor steel plate to concrete or solid masonry with expansion bolts.
 - b. Anchor steel plate to hollow masonry with toggle bolts.
2. Anchor flanged fitting with toggle bolt to steel support in frame walls.

C. Removable Rails:

1. Rest rails in brackets at each end and secure to bracket with stainless steel bolts and nuts where part of a continuous railing.
2. Rest rail posts in sleeves where not part of a continuous railing. Do not grout posts.

D. Gates:

1. Hang gate to swing as shown.
2. Bolt gate hinges to jamb post with clamp on or through bolts.

E. Handrails:

1. Anchor brackets for metal handrails as detailed.
2. Install brackets within 300 mm (12 inches) of return of walls, and at evenly spaced intermediate points not exceeding 1200 mm (4 feet) on centers unless shown otherwise.
3. Expansion bolt to concrete or solid masonry.
4. Toggle bolt to installed supporting frame wall and to hollow masonry unless shown otherwise.

3.10 STEEL COMPONENTS FOR MILLWORK ITEMS

Coordinate and deliver to Millwork fabricator for assembly where millwork items are secured to metal fabrications.

3.19 CLEAN AND ADJUSTING

- A. Adjust movable parts including hardware to operate as designed without binding or deformation of the members centered in the opening or frame and, where applicable, contact surfaces fit tight and even without forcing or warping the components.
- B. Clean after installation exposed prefinished and plated items and items fabricated from stainless steel, aluminum and copper alloys, as recommended by the metal manufacture and protected from damage until completion of the project.

- - - E N D - - -

SECTION 05 51 00
METAL STAIRS

PART 1 - GENERAL

1.1 DESCRIPTION

A. Section specifies steel stairs with railings.

B. Types:

1. Industrial stairs: Open riser

stairs. 1.2 RELATED WORK

A. Wall handrails and railings for other than steel stairs: Section 05 50 00, METAL FABRICATIONS.

B. Requirements for shop painting: Section 09 91 00,

PAINTING. 1.3 SUBMITTALS

A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

B. Shop Drawings: Show design, fabrication details, installation, connections, material, and size of members.

1.4 APPLICATION PUBLICATIONS

A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by basic designation.

B. American Society for Testing and Materials (ASTM):

A36/A36M-05Structural Steel

A47-99 (R2004)Ferritic Malleable Iron Castings

A48-03Gray Iron Castings

A53-06Pipe, Steel, Black and Hot-Dipped Zinc-Coated
Welded and Seamless

A307-07 Carbon Steel Bolts and Studs, 60000 psi Tensile
Strength

A653/653M-07 Steel Sheet, Zinc Coated (Galvanized) or Zinc Alloy
Coated (Galvannealed) by the Hot-Dip Process

A563-07Carbon and Alloy Steel Nuts

A1008-07Steel, Sheet, Cold-Rolled, Carbon, Structural,
High-Strength, Low-Alloy

A786/A786M-00Rolled Steel Floor Plates

A1011-04Steel, Sheet and Strip, Strip, Hot-Rolled
Carbon, Structural, High-Strength, Low-Alloy

C. American Welding Society (AWS):

D1.1-04 Structural Welding Code-Steel

D1.3-98 Structural Welding Code-Sheet Steel

- D. The National Association of Architectural Metal Manufactures
(NAAMM) Manuals:
 - Metal Bar Gratings (ANSI/NAAMM MBG 531-00)
 - AMP521-01 Pipe Railing Manual, Including Round Tube
- E. American Iron and Steel Institute (AISI):
 - 2001 Design of Cold-Formed Steel Structural Members

PART 2 - PRODUCTS

2.1 DESIGN CRITERIA

- A. Design stairs to support a live load of 500 kg/m² (100 pounds per square foot).
- B. Structural design, fabrication and assembly in accordance with requirements of NAAMM Metal Stairs Manual, except as otherwise specified or shown.
- C. Design Grating treads in accordance with NAAMM Metal Bar Grating Manual.
- D. Design pipe railings in accordance with NAAMM Pipe Railing Manual for 900 N (200 pounds) in any direction at any point.

2.2 MATERIALS

- A. Steel Pipe: ASTM A53, Standard Weight, zinc coated.
- B. Steel Grating: Metal bar type grating NAAMM BG.
- C. Structural Steel: ASTM A36.
- D. Steel Floor Plate: ASTM 786.
- E. Steel Plate: ASTM A1011.
- F. Iron Castings: ASTM A48, Class 30.
- G. Malleable Iron Castings: ASTM A47.

2.3 FABRICATION GENERAL

- A. Fasteners:
 1. Conceal bolts and screws wherever possible.
 2. Use countersunk heads on exposed bolts and screws with ends of bolts and screws dressed flush after nuts are set.
- B. Welding:
 1. Structural steel, AWS D1.1 and sheet steel, AWS D1.3.
 2. Where possible, locate welds on unexposed side.
 3. Grind exposed welds smooth and true to contour of welded member.
 4. Remove welding splatter.
- C. Remove sharp edges and burrs.
- D. Fit face stringer to newel post by tenoning into newel post, or by notching and fitting face stringer to side of newel where shown.
- E. Finish: Galvanized.

2.4 RAILINGS

- A. Fabricate railings, including handrails, from steel pipe as shown.
 - 1. Connections may be standard fittings designed for welding, or coped or mitered sections with full welds.
 - 2. Wall handrails are provided under Section 05 50 00, METAL FABRICATIONS.
- B. Return ends of handrail to wall and close free end.
- C. Space intermediate posts not over six feet on center between end post.
- D. Fabricate handrail brackets from cast malleable iron.
- E. Provide standard terminal fittings at ends of post and rails.
- F. Finish: Galvanized.

2.5 INDUSTRIAL STAIRS

- A. Provide treads, platforms, railings, stringers and other supporting members as shown.
- B. Treads and platforms of steel grating:
 - 1. Fabricate steel grating treads and platforms in accordance with requirements of NAAMM Metal Bar Grating Manuals.
 - 2. Provide end banding bars, except where carrier angle are used at tread ends.
 - 3. Support treads by use of carrier plates or carrier angle. Use carrier plate end banding bars on exterior stairs.
 - 4. Provide abrasive nosing on treads and edge of platforms at head of stairs.
 - 5. Provide toe plates on platforms where shown.
 - 6. Finish: Galvanized.

PART 3 - EXECUTION

3.1 STAIR INSTALLATION

- A. Provide hangers and struts required to support the loads imposed.
- B. Perform job site welding and bolting as specified for shop fabrication.
- C. Set stairs and other members in position and secure to structure as shown.
- D. Install stairs plumb, level and true to line.
- E. Provide steel closure plate to fill any gap between the stringer and surrounding shaft wall. Weld and touch-up abraded galvanized areas with zinc rich paint.

3.2 RAILING INSTALLATION

- A. Install standard terminal fittings at ends of posts and rails.

- B. Secure brackets, posts and rails to steel by welds, and to masonry or concrete with expansion sleeves and bolts, except secure posts at concrete by setting in sleeves filled with commercial non-shrink grout.
- C. Set rails horizontal or parallel to rake of stairs to within 3 mm in 3650 mm (1/8-inch in 12 feet).
- D. Set posts plumb and aligned to within 3 mm in 3650 mm (1/8-inch in 12 feet).

3.3 FIELD PRIME PAINTING

- A. Touch up abraded galvanized areas with zinc rich paint as specified in section 09 91 00, PAINTING.

- - - E N D - - -

SECTION 06 10 00 ROUGH
CARPENTRY

PART 1 - GENERAL

1.1 DESCRIPTION:

Section specifies wood blocking, furring, nailers, and rough hardware.

1.2 RELATED WORK:

- A. Milled woodwork: Section 06 20 00, FINISH CARPENTRY.
- B. Gypsum sheathing: Section 09 29 00, GYPSUM BOARD.

1.3 SUBMITTALS:

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

1.4 PRODUCT DELIVERY, STORAGE AND HANDLING:

- A. Protect lumber and other products from dampness both during and after delivery at site.
- B. Pile lumber in stacks in such manner as to provide air circulation around surfaces of each piece.
- C. Stack plywood and other board products so as to prevent warping.
- D. Locate stacks on well drained areas, supported at least 150 mm (6 inches) above grade and cover with well ventilated sheds having firmly constructed over hanging roof with sufficient end wall to protect lumber from driving rain.

1.5 APPLICABLE PUBLICATIONS:

- A. Publications listed below form a part of this specification to extent referenced. Publications are referenced in the text by basic designation only.
- B. American Forest and Paper Association (AFPA):
National Design Specification for Wood Construction
NDS-05 Conventional Wood Frame Construction
- C. American Institute of Timber Construction (AITC):
A190.1-02 Structural Glued Laminated Timber
- D. American Society of Mechanical Engineers (ASME):
B18.2.1A-96(R2005) Square and Hex Bolts and Screws
B18.2.2-87(R2005) Square and Hex Nuts
B18.6.1-81 (R97) Wood Screws
B18.6.4-98(R2005) Thread Forming and Thread Cutting Tapping Screws
and Metallic Drive Screws
- E. American Plywood Association (APA):
E30-03 Engineered Wood Construction Guide
- F. American Society for Testing And Materials (ASTM):

- A47-99(R2004)Ferritic Malleable Iron Castings
- A48-03Gray Iron Castings
- A653/A653M-07Steel Sheet Zinc-Coated (Galvanized) or Zinc-Iron Alloy Coated (Galvannealed) by the Hot Dip Process
- C954-04 Steel Drill Screws for the Application of Gypsum Board or Metal Plaster Bases to Steel Studs from 0.033 inch (2.24 mm) to 0.112-inch (2.84 mm) in thickness
- C1002-04 Steel Self-Piercing Tapping Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Wood Studs or Metal Studs
- D143-94(R2004) Small Clear Specimens of Timber, Method of Testing
- D1760-01Pressure Treatment of Timber Products
- D2559-04 Adhesives for Structural Laminated Wood Products for Use Under Exterior (Wet Use) Exposure Conditions
- D3498-03 Adhesives for Field-Gluing Plywood to Lumber Framing for Floor Systems
- F844-07 Washers, Steel, Plain (Flat) Unhardened for General Use
- F1667-05Nails, Spikes, and Staples
- G. Federal Specifications (Fed. Spec.):
- MM-L-736CLumber; Hardwood
- H. Commercial Item Description (CID):
- A-A-55615 Shield, Expansion (Wood Screw and Lag Bolt Self Threading Anchors)
- I. Military Specification (Mil. Spec.):
- MIL-L-19140ELumber and Plywood, Fire-Retardant Treated
- J. Truss Plate Institute (TPI):
- TPI-85Metal Plate Connected Wood Trusses
- K. U.S. Department of Commerce Product Standard (PS)
- PS 1-95Construction and Industrial Plywood
- PS 20-05American Softwood Lumber Standard

PART 2 - PRODUCTS**2.1 LUMBER:**

- A. Unless otherwise specified, each piece of lumber bear grade mark, stamp, or other identifying marks indicating grades of material, and rules or standards under which produced.
 - 1. Identifying marks in accordance with rule or standard under which material is produced, including requirements for qualifications and authority of the inspection organization, usage of authorized identification, and information included in the identification.
 - 2. Inspection agency for lumber approved by the Board of Review, American Lumber Standards Committee, to grade species used.
- B. Lumber Other Than Structural:
 - 1. Unless otherwise specified, species graded under the grading rules of an inspection agency approved by Board of Review, American Lumber Standards Committee.
 - 2. Furring, blocking, nailers and similar items 100 mm (4 inches) and narrower Standard Grade; and, members 150 mm (6 inches) and wider, Number 2 Grade.
- C. Sizes:
 - 1. Conforming to Prod. Std., PS20.
 - 2. Size references are nominal sizes, unless otherwise specified, actual sizes within manufacturing tolerances allowed by standard under which produced.
- D. Moisture Content:
 - 1. At time of delivery and maintained at the site.
 - 2. Boards and lumber 50 mm (2 inches) and less in thickness: 19 percent or less.
 - 3. Lumber over 50 mm (2 inches) thick: 25 percent or less.
- E. Fire Retardant Treatment:
 - 1. Mil Spec. MIL-L-19140 with piece of treated material bearing identification of testing agency and showing performance rating.
 - 2. Treatment and performance inspection, by an independent and qualified testing agency that establishes performance ratings.
- F. Preservative Treatment:
 - 1. Do not treat Heart Redwood and Western Red Cedar.
 - 2. Treat wood members and plywood exposed to weather or in contact with plaster, masonry or concrete, including framing of open roofed structures; sills, sole plates, furring, and sleepers that are less than 600 mm (24 inches) from ground; nailers, edge strips, blocking,

crickets, curbs, cant, vent strips and other members used in connection with roofing and flashing materials.

3. Treat other members specified as preservative treated (PT).
4. Preservative treat by the pressure method complying with ASTM D1760, except any process involving the use of Chromated Copper arsenate (CCA) for pressure treating wood is not permitted.

2.2 PLYWOOD

- A. Comply with Prod. Std., PS 1.
- B. Bear the mark of a recognized association or independent inspection agency that maintains continuing control over quality of plywood which identifies compliance by veneer grade, group number, span rating where applicable, and glue type.
- C. Sheathing:
 - 1. APA rated Exposure 1 or Exterior; panel grade CD or better.
 - 2. Roof: 19/32 APA rated fire resistant

plywood. 2.3 ROUGH HARDWARE AND ADHESIVES:

- A. Anchor Bolts:
 - 1. ASME B18.2.1 and ANSI B18.2.2 galvanized, 13 mm (1/2 inch) unless shown otherwise.
 - 2. Extend at least 200 mm (8 inches) into masonry or concrete with ends bent 50 mm (2 inches).
- B. Miscellaneous Bolts: Expansion Bolts: C1D, A-A-55615; lag bolt, long enough to extend at least 65 mm (2-1/2 inches) into masonry or concrete. Use 13 mm (1/2 inch) bolt unless shown otherwise.
- C. Washers
 - 1. ASTM F844.
 - 2. Use zinc or cadmium coated steel or cast iron for washers exposed to weather.
- D. Screws:
 - 1. Wood to Wood: ANSI B18.6.1 or ASTM C1002.
 - 2. Wood to Steel: ASTM C954, or ASTM C1002.
- E. Nails:
 - 1. Size and type best suited for purpose unless noted otherwise. Use aluminum-alloy nails, plated nails, or zinc-coated nails, for nailing wood work exposed to weather and on roof blocking.
 - 2. ASTM F1667:
 - a. Common: Type I, Style 10.
 - b. Concrete: Type I, Style 11.
 - c. Barbed: Type I, Style 26.
 - d. Underlayment: Type I, Style 25.
 - e. Masonry: Type I, Style 27.
 - f. Use special nails designed for use with ties, strap anchors, framing connectors, joists hangers, and similar items. Nails not less than 32 mm (1-1/4 inches) long, 8d and deformed or annular ring shank.

F. Adhesives:

1. For field-gluing plywood to lumber framing floor or roof systems: ASTM D3498.
2. For structural laminated Wood: ASTM D2559.

PART 3 - EXECUTION

3.1 INSTALLATION OF FRAMING AND MISCELLANEOUS WOOD MEMBERS:

A. Conform to applicable requirements of the following:

1. AFPA WCD-number 1, Manual for House Framing for nailing and framing unless specified otherwise.

B. Fasteners:

1. Nails.
 - a. Nail in accordance with the Recommended Nailing Schedule as specified in AFPA Manual for House Framing where detailed nailing requirements are not specified in nailing schedule. Select nail size and nail spacing sufficient to develop adequate strength for the connection without splitting the members.
2. Bolts:
 - a. Fit bolt heads and nuts bearing on wood with washers.
 - b. Countersink bolt heads flush with the surface of nailers.
 - c. Embed in concrete and solid masonry or use expansion bolts. Special bolts or screws designed for anchor to solid masonry or concrete in drilled holes may be used.
 - d. Use toggle bolts to hollow masonry or sheet metal.
 - e. Use bolts to steel over 2.84 mm (0.112 inch, 11 gage) in thickness. Secure wood nailers to vertical structural steel members with bolts, placed one at ends of nailer and 600 mm (24 inch) intervals between end bolts. Use clips to beam flanges.
3. Drill Screws to steel less than 2.84 mm (0.112 inch) thick.
 - a. ASTM C1002 for steel less than 0.84 mm (0.033 inch) thick.
 - b. ASTM C 954 for steel over 0.84 mm (0.033 inch) thick.
4. Power actuated drive pins may be used where practical to anchor to solid masonry, concrete, or steel.
5. Do not anchor to wood plugs or nailing blocks in masonry or concrete. Use metal plugs, inserts or similar fastening.
6. Screws to Join Wood:
 - a. Where shown or option to nails.
 - b. ASTM C1002, sized to provide not less than 25 mm (1 inch) penetration into anchorage member.
 - c. Spaced same as nails.

- C. Cut notch, or bore in accordance with NFPA Manual for House-Framing for passage of ducts wires, bolts, pipes, conduits and to accommodate other work. Repair or replace miscut, misfit or damaged work.
- D. Blocking Nailers, and Furring:
 - 1. Install furring, blocking, nailers, and grounds where shown.
 - 2. Use longest lengths practicable.
 - 3. Use fire retardant treated wood blocking where shown at openings and where shown or specified.
 - 4. Layers of Blocking or Plates:
 - a. Stagger end joints between upper and lower pieces.
 - b. Nail at ends and not over 600 mm (24 inches) between ends.
 - c. Stagger nails from side to side of wood member over 125 mm (5 inches) in width.
- E. Rough Bucks:
 - 1. Install rough wood bucks at opening in masonry or concrete where wood frames or trim occur.
 - 2. Brace and maintain bucks plumb and true until masonry has been built around them or concrete cast in place.
 - 3. Cut rough bucks from 50 mm (2 inch) thick stock, of same width as partitions in which they occur and of width shown in exterior walls.
 - 4. Extend bucks full height of openings and across head of openings; fasten securely with anchors specified. - -
- E N D - - -

SECTION 06 20 00 FINISH
CARPENTRY

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This section specifies exterior and interior millwork.
- B. Items specified.
 - Wall Paneling
 - Book Shelves
 - Custom Casework
 - Wood Window Casing/Apron
 - Memory Shelf
 - Chair Rail
 - Crown Moldings
 - Base

1.2 RELATED WORK

- A. Fabricated Metal brackets and supports: Section 05 50 00, METAL FABRICATIONS.
- B. Framing, furring and blocking: Section 06 10 00, ROUGH CARPENTRY.
- C. Wood Doors: Section 08 14 00, WOOD DOORS.
- D. Wood Windows: Section 08 52 00, WOOD WINDOWS.
- E. Other Countertops: Division 11, EQUIPMENT and Division 12, FURNISHINGS.
- F. Electrical light fixtures and duplex outlets: Division 26, ELECTRICAL.

1.3 SUBMITTALS

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Shop Drawings:
 - 1. Millwork items - Half full size scale for sections and details 1:50 (1/4-inch) for elevations and plans.
 - 2. Show construction and installation.
- C. Samples:
 - Plastic laminate finished plywood or particleboard, 150 mm by 300 mm (six by twelve inches).
- D. Manufacturer's literature and data:
 - 1. Finish hardware
 - 2. Sinks with fittings
 - 3. Electrical components

1.4 DELIVERY, STORAGE AND HANDLING

- A. Protect lumber and millwork from dampness, maintaining moisture content specified both during and after delivery at site.
- B. Store finishing lumber and millwork in weathertight well ventilated structures or in space in existing buildings designated by COTR. Store at a minimum temperature of 21⁰C (70⁰F) for not less than 10 days before installation.
- C. Pile lumber in stacks in such manner as to provide air circulation around surfaces of each piece.

1.5 APPLICABLE PUBLICATIONS

- A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.
- B. American Society of Testing and Materials (ASTM):
 - A36/A36M-08 Structural Steel
 - A53-07 Pipe, Steel, Black and Hot-Dipped Zinc Coated, Welded and Seamless
 - A167-99 (R2009) Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip
 - B26/B26M-09 Aluminum-Alloy Sand Castings
 - B221-08 Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes
 - E84-09 Surface Burning Characteristics of Building Materials
- C. American Hardboard Association (AHA):
 - A135.4-04 Basic Hardboard
- D. Builders Hardware Manufacturers Association (BHMA):
 - A156.9-03 Cabinet Hardware
 - A156.11-04 Cabinet Locks
 - A156.16-02 Auxiliary Hardware
- E. Hardwood Plywood and Veneer Association (HPVA):
 - HP1-09 Hardwood and Decorative Plywood
- F. National Particleboard Association (NPA):
 - A208.1-99 Wood Particleboard
- G. American Wood-Preservers' Association (AWPA):
 - AWPA C1-03 All Timber Products - Preservative Treatment by Pressure Processes
- H. Architectural Woodwork Institute (AWI):

- AWI-99 Architectural Woodwork Quality Standards and
Quality Certification Program
- I. National Electrical Manufacturers Association (NEMA):
LD 3-05 High-Pressure Decorative Laminates
- J. U.S. Department of Commerce, Product Standard (PS):
PS20-05 American Softwood Lumber Standard
- K. Military Specification (Mil. Spec.):
MIL-L-19140E Lumber and Plywood, Fire-Retardant Treated
- L. Federal Specifications (Fed. Spec.):
A-A-1922A Shield Expansion
A-A-1936 Contact Adhesive
FF-N-836D Nut, Square, Hexagon Cap, Slotted, Castle
FF-S-111D(1) Screw, Wood
MM-L-736(C) Lumber, Hardwood

1.6 QUALITY ASSURANCE

- A. Comply with AWI Custom Grade Construction Standards for Architectural Woodwork and Interior Millwork, unless otherwise specified.

PART 2 - PRODUCTS

2.1 LUMBER

- A. Grading and Marking:
1. Lumber shall bear the grade mark, stamp, or other identifying marks indicating grades of material.
 2. Such identifying marks on a material shall be in accordance with the rule or standard under which the material is produced, including requirements for qualifications and authority of the inspection organization, usage of authorized identification, and information included in the identification.
 3. The inspection agency for lumber shall be approved by the Board of Review, American Lumber Standards Committee, to grade species used.
- B. Sizes:
1. Lumber Size references, unless otherwise specified, are nominal sizes, and actual sizes shall be within manufacturing tolerances allowed by the standard under which product is produced.
 2. Millwork, standing and running trim, and rails: Actual size as shown or specified.
- C. Hardwood: MM-L-736, species as specified for each item.
- D. Softwood: PS-20, exposed to view appearance grades:
1. Use C select or D select, vertical grain for transparent finish including stain transparent finish.

2. Use Prime for painted or opaque finish.

E. Use edge grain Wood members exposed to weather. **2.2 PLYWOOD**

A. Softwood Plywood:

1. Prod. Std.

2. Grading and Marking:

a. Each sheet of plywood shall bear the mark of a recognized association or independent inspection agency that maintains continuing control over the quality of the plywood.

b. The mark shall identify the plywood by species group or identification index, and shall show glue type, grade, and compliance with PS1.

3. Plywood, 13 mm (1/2 inch) and thicker; not less than five ply construction, except 32 mm (1-1/4 inch) thick plywood not less than seven ply.

4. Plastic Laminate Plywood Cores:

a. Exterior Type, and species group.

b. Veneer Grade: A-C.

5. Shelving Plywood:

a. Interior Type, any species group.

b. Veneer Grade: A-B or B-C.

6. Other: As specified for item.

B. Hardwood Plywood:

1. HPVA: HP.1

2. Species of face veneer shall be as shown or as specified in connection with each particular item.

3. Inside of Building:

a. Use Type II (interior) A grade veneer for transparent finish.

b. Use Type II (interior) Sound Grade veneer for paint finish.

4. On Outside of Building:

a. Use Type I, (exterior) A Grade veneer for natural or stained and varnish finish.

b. Use Type I, (exterior) Sound Grade veneer for paint finish.

5. Use rotary cut white birch unless specified otherwise. **2.3 PARTICLEBOARD**

A. NPA A208.1

B. Plastic Laminate Particleboard Cores:

1. Use industrial grade, medium density, Grade M-2 Particle Board, unless otherwise specified.

2. Use industrial grade, medium density, Grade M-2 Particle Board, for tops with sink(s).

C. General Use:

1. Use industrial grade, medium density, Grade M-2 Particle Board, unless otherwise specified.
2. Use industrial grade, medium density, Grade M-2 Particle Board, for tops with sink(s).

2.4 PLASTIC LAMINATE

- A. NEMA LD-3.
- B. Exposed decorative surfaces including countertops, both sides of cabinet doors, and for items having plastic laminate finish. General Purpose, Type HGL.
- C. Cabinet Interiors including Shelving: Both of following options to comply with NEMA, CLS as a minimum.
 1. Plastic laminate clad plywood or particle board.
 2. Resin impregnated decorative paper thermally fused to particle board.
- D. Backing sheet on bottom of plastic laminate covered wood tops: Backer, Type HGP.
- E. Post Forming Fabrication, Decorative Surfaces: Post forming, Type HGP.
- F. Laminate Thickness for Casework:
 1. Countertop Surfaces: .050" unless otherwise specified.
 2. All Other Surfaces: .028" (vertical grade) unless otherwise specified.

2.5 BUILDING BOARD (HARDBOARD)

- A. ANSI/AHA A135.4, 6 mm (1/4 inch) thick unless specified otherwise.
- B. Perforated hardboard (Pegboard): Type 1, Tempered perforated 6 mm (1/4 inch) diameter holes, on 25 mm (1 inch) centers each way, smooth surface one side.
- C. Wall paneling at gas chain rack: Type 1, tempered, Fire Retardant treated, smooth surface on side.

2.6 ADHESIVE

- A. For Plastic Laminate: Fed. Spec. A-A-1936.
- B. For Interior Millwork: Unextended urea resin, unextended melamine resin, phenol resin, or resorcinol resin.

2.7 STAINLESS STEEL

ASTM A167, Type 302 or 304.

2.8 ALUMINUM CAST

ASTM B26

2.9 ALUMINUM EXTRUDED

ASTM B221

2.10 HARDWARE

A. Rough Hardware:

1. Furnish rough hardware with a standard plating, applied after punching, forming and assembly of parts; galvanized, cadmium plated, or zinc-coated by electric-galvanizing process. Galvanized where specified.
2. Use galvanized coating on ferrous metal for exterior work unless nonferrous metals or stainless is used.
3. Fasteners:
 - a. Bolts with Nuts: FF-N-836.
 - b. Expansion Bolts: A-A-1922A.
 - c. Screws: Fed. Spec. FF-S-111.

B. Finish Hardware

1. Cabinet Hardware: ANSI A156.9.
 - a. Door/Drawer Pulls: 100 mm (4 inches) long, 8 mm (5/16 inches) in diameter, oil rubbed, bronze finish.
 - b. Drawer Slides:
 1. Pencil Drawer Slides: Knape & Vogt #8200 or #8250 as appropriate, 75 lb. class, 3/4" extension, or approved equal.
 2. Box Drawers up to 6" deep: Knape & Vogt #8300, 75 lb. class, 3/4" extension, or approved equal.
 3. Box Drawers over 6" deep and File Drawers: Knape & Vogt #8500, 150 lb. class, full extension for 12" and 14" long drawers, or approved equal. Knape & Vogt #8520, 175 lb. class, full extension for drawers long than 14".
 - c. Pocket Drawer Slides: Blum #270E series, or approved equal.
 - d. Shelf Clips: Hafele #282.04.524, plug-in 32 mm spoon type, or approved equal, oil rubbed, bronze finish.
 - e. Shelf Brackets: Hafele 287.35.159, or approved equal.
 - f. Concealed (European type) Hinges: B01602, Blum self-closing, full overlay, 125 degrees, nickel plated, clip style, or approved equal.
 - g. Door Locks: E07121. Keyed alike within an area, different areas keyed differently, oil rubbed, bronze finish.
 - h. Drawer Locks: E07041. Keyed alike within an area, different areas keyed differently, oil rubbed, bronze finish.
 - i. Door silencers: Clear plastic with self-adhesive.

2. Cabinet Locks: ANSI A156.11.
 - a. Drawers and Hinged Door: E07262.
 - b. Sliding Door: E07162.
3. Auxiliary Hardware: ANSI A156.16.
 - a. Shelf Bracket: B04041, japanned or enameled finish.
 - b. Handrail Brackets: L03081 or L03101.
 - 1) Cast Aluminum, satin polished finish.
 - 2) Cast Malleable Iron, japanned or enamel finish.
4. Steel Channel Frame and Leg supports for Counter top. Fabricated under Section 05 50 00, METAL FABRICATIONS.
5. Thru-Wall Counter Brackets:
 - a. Steel angles drilled for fasteners on 100 mm (4 inches) centers.
 - b. Baked enamel prime coat finish.
6. Edge Strips Moldings:
 - a. Driven type "T" shape with serrated retaining stem; vinyl plastic to match plastic laminate color, stainless steel, or 3 mm (1/8 inch) thick extruded aluminum.
7. Primers: Manufacturer's standard primer for steel providing baked enamel finish.

2.11 MOISTURE CONTENT

- A. Moisture content of lumber and millwork at time of delivery to site.
 1. Interior finish lumber, trim, and millwork 32 mm (1-1/4 inches) or less in nominal thickness: 12 percent on 85 percent of the pieces and 15 percent on the remainder.
 2. Exterior treated or untreated finish lumber and trim 100 mm (4 inches) or less in nominal thickness: 15 percent.
 3. Moisture content of other materials shall be in accordance with the standards under which the products are produced.

2.12 FIRE RETARDANT TREATMENT

- A. Where wood members and plywood are specified to be fire retardant treated, the treatment shall be in accordance with Mil. Spec. MIL-L19140.
- B. Treatment and performance inspection shall be by an independent and qualified testing agency that establishes performance ratings.
- C. Each piece of treated material shall bear identification of the testing agency and shall indicate performance in accordance with such rating of flame spread and smoke developed.
- D. Treat wood for maximum flame spread of 25 and smoke developed of 25.
- E. Fire Resistant Softwood Plywood:

1. Use Grade A, Exterior, plywood for treatment.
 2. Meet the following requirements when tested in accordance with ASTM E84.
 - a. Flame spread: 0 to 25.
 - b. Smoke developed: 100 maximum
- F. Fire Resistant Hardwood Plywood:
1. Core: Fire retardant treated softwood plywood.
 2. Hardwood face and back veneers untreated,
 3. Factory seal panel edges, to prevent loss of fire retardant salts.

2.13 PRESERVATIVE TREATMENT

- A. Wood members and plywood exposed to weather or in contact with plaster, masonry or concrete, including wood members used for rough framing of millwork items except heart-wood Redwood and Western Red Cedar shall be preservative treated in accordance with AWPA Standards.
- B. Use Grade A, exterior plywood for treatment.

2.14 FABRICATION

A. General:

- 1. Except as otherwise specified, use AWI Custom Grade for architectural woodwork and interior millwork.
- 2. Finish woodwork shall be free from pitch pockets.
- 3. Except where special profiles are shown, trim shall be standard stock molding and members of the same species.
- 4. Plywood shall be not less than 13 mm (1/2 inch), unless otherwise shown or specified.
- 5. Edges of members in contact with concrete or masonry shall have a square corner caulking rebate.
- 6. Fabricate members less than 4 m (14 feet) in length from one piece of lumber, back channeled and molded as shown.
- 7. Interior trim and items of millwork to be painted may be fabricated from jointed, built-up, or laminated members, unless otherwise shown on drawings or specified.
- 8. Plastic Laminate Work:
 - a. Factory glued to either a plywood or a particle board core, thickness as shown or specified.
 - b. Cover exposed edges with plastic laminate, except where aluminum, stainless steel, or plastic molded edge strips are shown or specified. Use plastic molded edge strips on 19 mm (3/4-inch) molded thick or thinner core material.
 - c. Provide plastic backing sheet on underside of countertops, vanity tops, including back splashes and end splashes of countertops.
 - d. Use backing sheet on concealed large panel surface when decorative face does not occur.

B. Book Shelves:

- 1. Fabricate from white birch.
- 2. AWI Premium Grade construction in conformance with AWI Section 400, Casework.
- 3. Fabricate in one piece whenever possible to minimize joints.
- 4. Slightly round exposed edges.

5. Stain or paint per Drawings.
- C. Custom Casework:
1. Fabricate from white birch.
 2. AWI Premium Grade construction in conformance with AWI Section 400, Casework.
 3. Slightly round exposed edges.
 4. Fabricate in one piece whenever possible to minimize joints.
 5. Stain or paint per Drawings.
- D. Wood Window Casing/Apron:
1. Fabricate from white birch.
 2. Fabricate to sizes shown on Drawings.
 3. Fabricate in one full piece for full length from corner to corner up to 3600 mm (12 feet).
 4. Join pieces with adhesive sealant.
- E. Crown Molding:
1. Fabricate from white birch.
 2. Fabricate to sizes shown on Drawings.
 3. Fabricate in one full piece for full length of room whenever practical up to 12 feet (3600 mm).
 4. Stain or paint per Drawings.
- F. Wall Paneling:
1. Basis-of-Design: Marlite-Plank Wall System.
 2. High Density Fiberboard.
 - a. Vertical V-grooved planked.
 - b. Thickness: 19 mm (1/4 inch) unless shown otherwise.
 - c. Painted or stained per Drawings.
 - d. Use full height panels where possible without end joints.
 3. Trim and base:
 - a. Fabricate from white birch.
 - b. Size and shape per Drawings.

2.15 SOLID POLYMER MATERIAL:

- A. Filled Methyl Methacrylic Polymer.
- B. Performance properties required.

Property	Result	Test
Elongation	0.3% min.	ASTM D638
Hardness	90 Rockwell M	ASTM D785
Gloss (60° Gordon)	5-20	NEMA LD3.1
Color Stability	No Change	NEMA LD3 except 200 hour

Abrasion Resistance	No loss of pattern Max wear depth 0.0762 mm (0.003 in) - 10000 cycles	NEMA LD3
Water absorption weight (5 max)	24 hours 0.9	ASTM D-570
Izod impact	14 N·m/m (0.25 ft-lb/in)	ASTM D256 (Method A)
Impact resistance	No fracture	NEMA LD-3 900 mm (36") drop 1 kg (2 lb.) ball
Boiling water surface resistance	No visible change	NEMA LD3
High temperature resistance	Slight surface dulling	NEMA LD3

- C. Cast into sheet form and bowl form.
- D. Color throughout with subtle veining through thickness.
- E. Dupont "Corian" is an acceptable product for meeting the above properties.
- F. Joint adhesive and sealer: Manufacturers silicone adhesive and sealant for joining methyl methacrylic polymer sheet.

PART 3 - EXECUTION

3.1 ENVIRONMENTAL REQUIREMENTS

- A. Maintain work areas and storage areas to a minimum temperature of 21°C (70°F) for not less than 10 days before and during installation of interior millwork.
- B. Do not install finish lumber or millwork in any room or space where wet process systems such as concrete, masonry, or plaster work is not complete and dry.

3.2 INSTALLATION

- A. General:
 1. Millwork receiving transparent finish shall be primed and back-painted on concealed surfaces. Set no millwork until primed and back-painted.
 2. Secure trim with fine finishing nails, screws, or glue as required.
 3. Set nails for putty stopping. Use washers under bolt heads where no other bearing plate occurs.

4. Seal cut edges of preservative and fire retardant treated wood materials with a certified acceptable sealer.
5. Coordinate with plumbing and electrical work for installation of fixtures and service connections in millwork items.
6. Plumb and level items unless shown otherwise.
7. Nail finish at each blocking, lookout, or other nailer and intermediate points; toggle or expansion bolt in place where nails are not suitable.

B. Wall Paneling:

1. Install edge trim and base as indicated on Drawings, use solid wood members.
2. High Density Paneling:
 - a. Install per manufacturer's recommendations.
 - b. Install panels with long edge vertically and end joints aligned where exposed to view.
 - c. Align V-grooves where end joints meet and maintain continuity of pattern.

C. Install with butt joints in straight runs and miter at corners.

- - - E N D - - -

THIS PAGE INTENTIONALLY LEFT BLANK

**SECTION 06 61 40
COMPOSITE SURFACING**

PART 1 - GENERAL

1.1. DESCRIPTION

A. This Section includes composite surfacing for the following applications:

1. Countertops.
2. Bathroom vanities/lavatories.

1.2. RELATED SECTIONS

- A. Section 055000 - Metal Fabrications: Blocking.
- B. Section 062000 - Finish Carpentry: Plywood substrate.
- C. Section 079200 - Joint Sealers: Joint sealant and backing materials.
- D. Section 154100 - Plumbing Fixtures: Sinks, faucets.

1.3. SUBMITTALS

A. Submit under provisions of Section 013323.

B. Product Data: Manufacturer's data sheets on each product to be used, including:

1. Product description.
2. Fabrication instructions and recommendations.
3. Storage and handling requirements and recommendations.
4. Installation methods.

C. Shop Drawings:

1. Indicate dimensions, edge configurations, cutouts, and relationship to adjacent construction.
2. Show locations and sizes of furring, blocking, including concealed blocking and reinforcement specified in other Sections.
3. Show locations and sizes of cutouts and holes for plumbing fixtures, faucets, soap dispensers, waste receptacle and other items installed in durable surfaces.

D. Samples:

1. For each type of product indicated.
 - a. Submit minimum 4 by 4 inch (102 by 102 mm) sample in specified gloss.
 - b. Cut sample and seam together for representation of inconspicuous seam.
 - c. Indicate full range of color and pattern variation.
2. Approved samples will be retained as a standard for Work.

- E. Maintenance Data: Cleaning instructions, scratch removal procedures, and materials harmful to countertops.

1.4. REFERENCES

- A. ASTM C 97 - Test Method for Absorption and Bulk Specific Gravity of Dimensional Stone.
- B. ASTM C 109 - Standard Test Method for Compressive Strength of Hydraulic Cement Mortars (Using 2 inch (50-mm) Cube Specimens).
- C. ASTM C 293 - Standard Test Method for Flexural Strength of Concrete (Using Simple Beam with Center-Point Loading).
- D. ASTM C 642 - Standard Test Method for Density, Absorption, and Voids in Hardened Concrete.
- E. ASTM C 666 - Standard Test Method for Resistance of Concrete to Rapid Freezing and Thawing (Superseded).
- F. ASTM C 1028 - Standard Test Method for Determining the Static Coefficient of Friction of Ceramic Tile and Other Like Surfaces by the Horizontal Dynamometer Pull-Meter Method.
- G. ASTM C 1260 - Standard Test Method for Potential Alkali Reactivity of Aggregates (Mortar-Bar Method).
- H. ASTM E 84 - Standard Test Method for Surface Burning Characteristics of Building Materials.
- I. NSF/ANSI 51 - Food Equipment Materials, Food

Contact. 1.5. QUALITY ASSURANCE

- A. Mock-Up: Provide a mock-up for evaluation of surface preparation techniques and application workmanship.
 - 1. Finish areas designated by COTR.
 - 2. Do not proceed with remaining work until workmanship, color, and sheen are approved by COTR.
 - 3. Refinish mock-up area as required to produce acceptable work.

- B. Installer: Trained and approved by composite

surfacing. 1.6. DELIVERY, STORAGE, AND HANDLING

- A. Do not deliver components to project site until products are ready for installation.
- B. Store components indoors prior to installation.
- C. Handle materials to prevent damage.
- D. Provide protective coverings to prevent physical damage or staining following installation for duration of project.

1.7. PROJECT CONDITIONS

- A Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's absolute limits.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Basis-of-Design Solid Surface Manufacturer: IceStone, 63 Flushing Avenue, Unit 283, Bldg. 12, Brooklyn, NY 11205. Telephone: (718) 624-4900. Fax: (718) 624-4002. Web: www.icestone.biz. [E-mail: info@icestone.biz](mailto:info@icestone.biz).
- B. Basis-of-Design Integral Counter/Lavatory Manufacturer: Dupont surfaces.
- C. Substitutions: Subject to requirements, provide products by manufacturer indicated, or approved equal.

2.2 MATERIAL

- A. A. Approved Product: IceStone.
1. Composition: 100 percent recycled glass in a cement matrix.
 2. Physical Performance Characteristics:
 - a. Compressive Strength: 13,000 psi (914 Km/cm), in accordance with ASTM C 109.
 - b. Flexural Strength: 890 psi (63 Km/cm), in accordance with ASTM C 293.
 - c. Specific Gravity: 2.31, in accordance with ASTM C 97.
 - d. Porosity/Absorption: 0.18 percent, unsealed, in accordance with ASTM C 642.
 - e. Chemical Durability: 0.05 percent expansion, in accordance with ASTM C 1260 for ASR Reactivity.
 - d. Freeze Thaw: 0.49 percent expansion, 300 cycles, in accordance with ASTM C666.
 - e. Fire Rating: Class 1 (A), in accordance with ASTM E 84. Flame spread index: 0. Fuel contribution: 0. Smoke density index: 0.
 - f. Polished Finish, Coefficient of Static Friction: 0.69 (dry); 0.61 (wet), ASTM C 1028.
 - g. Honed Finish, Coefficient of Static Friction: 0.71 (dry); 0.62 (wet), ASTM C 1028.
 - h. Sandblasted Finish, Coefficient of Static Friction: 0.85 (dry); 0.77 (wet), ASTM C 1028.

3. Weight and Size:
 - a. Weight: 16.3 pounds per square foot at 1-1/4 inches (32 mm) thick.
 - b. Maximum Slab Size: 52-1/2 inches (1334 mm) wide, 96 inches (2438 mm) long and 1-1/4 inches (32 mm) thick.
 - c. Finished Thickness: As indicated on Drawings.
4. Edge Detail:
 - a. As indicated on Drawings.
5. Color:
 - a. Aurora Gold.
6. Surface Finish:
 - a. Polished, high-gloss.
 - b. Honed.
 - c. Sandblasted.
- B. Approved Product: Dupont Corian vanity with integrated bowl.
 1. Composition: Cast, nonporous, filled polymer, non-coated, composite construction with through body colors meeting ANSI 2124.3 or ANSI 2124.6.
 2. Physical Performance Characteristics:
 - a. Tensile Strength: 6,000 psi, in accordance with ASTM D 638.
 - b. Flexural Strength: 10,000 psi, in accordance with ASTM D 790.
 - c. Specific Gravity: 1.7, in accordance with ASTM C 97.
 - d. Porosity/Absorption: 0.6 percent, unsealed, in accordance with ASTM D 570.
 - e. Thermal Expansion: 3.02×10^{-5} (in/in/°C), in accordance with ASTM D696.
 - e. Fire Rating: Class 1 (A), in accordance with ASTM E 84. Flame spread index: <25. Smoke developed index: <25.
 - g. Honed Finish, Coefficient of Static Friction: 0.71 (dry); 0.62 (wet), ASTM C 1028.
 3. Weight and Size:
 - a. Weight: 4.4 pounds per square foot at 1/2 inch (12.3 mm) thick.
 - b. Finished Thickness: As indicated on Drawings.
 4. Design:
 - a. 34" high counter
 - b. Standard front overflow
 - c. 24" wide counter - radius to match bowl.
 - d. Bowl position - forward on counter to meet ADA guidelines.

- 5. Color:
 - a. Select from Manufacturer's standard finishes.
- 6. Surface Finish:
 - b. Honed.

2.3 ACCESSORIES

- A. Sealant: Low-VOC or no-VOC mildew-resistant sealant, FDA-compliant, NSF 51-compliant for food contact, to match durable surface. Apply sealer per the sealer manufacturer's instructions to protect surface from staining.
 - 1. Product: As recommended by composite surfacing manufacturer.
 - a. Miracle 511 H2O Plus.
 - b. Nano 1000 Sealer.
 - c. Buddy Rhodes Natural Look Penetrating + Satin Sealer.
 - d. Protex by Tenax.
- B. Wax: Apply wax after installation to protect surface from staining or etching. Consult Manufacturer.
 - 1. Cheng's Concrete Countertop Wax
 - 2. Goddard's Granite and Marble Liquid Polish

2.4 FACTORY FABRICATION

- A. Shop Assembly: Fabricate using standard stone cutting equipment in accordance with manufacturer's fabrication and installation guidelines.
 - 1. Fabricate components to greatest extent practical to sizes and shapes indicated, in accordance with approved shop drawings and manufacturer's printed instructions.
 - 2. Form joints between components without conspicuous joints.
 - 3. Provide factory cutouts for plumbing fittings and bath accessories as indicated on Drawings.
 - 4. Rout and finish component edges with minimum radius of 1/8 (3 mm).
 - a. Rout cutouts, radii and contours to template.
 - b. Shape inside corner radius to minimum of 1/4 inch (6 mm) to relieve corner stress.
 - c. Smooth edges.
 - d. Repair or replace defective and inaccurate

work. PART 3 - EXECUTION

3.1 EXAMINATION

- A. Do not begin installation until substrates have been properly prepared.
- B. If substrate preparation is the responsibility of another installer, notify COTR of unsatisfactory preparation before proceeding.

3.2 PREPARATION

A. Clean surfaces thoroughly prior to installation.

B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions. 3.3

INSTALLATION A. Install in accordance with

manufacturer's instructions including but not limited to the following:

1. Four-Sided Perimeter Support: Provide a four-sided perimeter frame for countertops, and IceStone will not require a substrate. Provide front-to-back support every 36 inches (914 mm), in addition to the strong perimeter support, for spans within cabinets.
2. Three-Sided Perimeter Support: For structures that have perimeter support on three sides (desks and frameless cabinets) additional support is required. IceStone with a depth of less than 26 inches (660 mm) require supports every 24 inches (610 mm). IceStone with depths of over 26 inches (660 mm) require supports every 18 inches (457 mm).
3. Cantilevers: Cantilevers less than 9 inches (228 mm) do not always require additional support. Cantilevers of 9 to 12 inches (228 to 305 mm) require either corbels or front to back rod support every 24 inches (610 mm). Cantilevers greater than 12 inches (305 mm) require legs, columns or either stainless steel or aluminum reinforcing rods every 24 inches (610 mm).
4. Support Rods: Either stainless steel or aluminum to avoid rusting which could produce bleed through staining.
5. Cutouts and Rod Supports: Undermount sinks will require 3 inches (76 mm). All openings need to be rodded for extra support and that some openings will need to be field cut. Support cutouts with 1/8 by 1/2 inch (3 by 12 mm) stainless steel or aluminum strips set vertically in 3/4 inch (19 mm) deep saw blade kerf positioned in the center of both the front and back bridge to extend a minimum of 24 inches (610 mm) beyond the opening to the left and to the right. Encapsulate the reinforcement "rod" with AKEMI Marmorkitt 1000 Waterclear Flowing 2 Part Polyester Adhesive.

6. Install components plumb, level and rigid, scribed to adjacent finishes, in accordance with approved shop drawings and product data.
 - a. Provide product in the largest pieces available.
 - b. Form field joints using manufacturer's recommended adhesive, with joints inconspicuous in finished work.
 - c. Exposed joints/seams shall not be allowed.
 - d. Reinforce field joints with solid surface strips extending a minimum of 1 inch on either side of the seam with the strip being the same thickness at the top.
 - e. Cut and finish component edges with clean, sharp returns.
 - f. Rout radii and contours to template.
 - g. Anchor securely to base cabinets or other supports.
 - h. Align adjacent countertops and form seams to comply with manufacturer's written recommendations using adhesive in color to match countertop.
 - i. Carefully dress joints smooth, remove surface scratches and clean entire surface.
 - j. Install countertops with no more than 1/8-inch (3 mm) sag, bow or other variation from a straight line.
- B. Clean and polish surfaces in accordance with manufacturer's care and maintenance instructions including the following:
 1. Cleaner: Clean spills promptly. Longer exposure to spills may result in a stain. IceStone recommends TileLab OneStep Cleaner & Resealer, Seventh Generation All Purpose Cleaner, Simple Green Stone Cleaner. Pledge Multipurpose Pads, clean and offer a light layer of wax protection. Generally low Ph cleaners work best.
 2. Polish: IceStone recommends applying a wax after installation and sealing to protect the surface from straining or etching. IceStone recommends Cheng's Concrete Countertop Wax and Goddard's Granite and Marble Liquid Polish.

3.4 PROTECTION

- A. Protect installed products until completion of project.
- B. Touch-up, repair or replace damaged products before Substantial Completion, as directed by COTR.

- - - E N D - - -

THIS PAGE INTENTIONALLY LEFT BLANK

SECTION 06446
ARCHITECTURAL COMPOSITE COLUMNS

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Columns: HB&G PermaCast Load-bearing columns; fiber-reinforced polymer composite; weatherproof, insect-proof, and highly durable.
- B. Decorative Capitals and Bases: To fit over shaft through center of capital and base without affecting height of the column, except for "ornate" styles of capitals for round columns.
- C. Materials for column installation.

1.2 RELATED SECTIONS

- A. Section 06 10 00 - Rough Carpentry: Wood framing.
- B. Section 06 61 42 - Architectural Wood

Columns. **1.3 SUBMITTALS**

- A. Submit under provisions of Section 01 30 00.
- B. Manufacturer's data sheets on each product to be used, including:
 - 1. Preparation instructions and recommendations.
 - 2. Storage and handling requirements and recommendations.
 - 3. Installation methods.
- C. Shop Drawings: For custom products, show dimensions, configuration, and anchorages.
- D. Selection Samples: Two complete sets of color photographs representing manufacturer's full range of available materials and styles.

1.4 DELIVERY, STORAGE, AND HANDLING

- A. Store products in manufacturer's unopened packaging until ready for installation.
- B. Store and dispose of solvent-based materials, and materials used with solvent-based materials, in accordance with requirements of local authorities having jurisdiction.

1.5 PROJECT CONDITIONS

- A. Maintain environmental conditions (temperature, humidity and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's absolute limits.

1.6 WARRANTY

- A. At project closeout, provide to Owner or Owners Representative a copy of the manufacturer's limited warranty outlining its terms and conditions.
 - 1. Duration: Lifetime limited warranty extended to original owner.

- B. Free from defects in material and workmanship for "lifetime" of ownership. Installation must be per manufacturer's guidelines. "Lifetime" means as long as purchaser of column owns the structure to which column is attached".
- C. Free from defects in material and workmanship for "lifetime" of ownership. Installation must be per manufacturer's guidelines. "Lifetime" means "as long as purchaser of column owns the structure to which column is attached".

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Basis-of-Design Manufacturer: HB&G, which is located at: P. O. Box 589 ; Troy, AL 36081; Toll Free Tel: 800-264-4424; Tel: 334-566-5000; Fax: 334-566-4629; [Email: tbobo@hbgcolumns.net](mailto:tbobo@hbgcolumns.net); Web: www.hbgcolumns.com
- B. Provide manufacturer listed or approved

equal. 2.2 LOAD BEARING COLUMNS - ROUND

- A. PermaCast Column:
 1. Height: 10 feet (3048 mm) - Building 'A'.
 2. Height: 24 feet 3" (7391 mm) - Building 'B'.
 3. Size: 18 inches (457 mm) diameter; load limit: 20,000 pounds (9072 kg) per column - Building 'A'..
 4. Size: 24 inches (610 mm) diameter; load limit: 20,000 pounds (9072 kg) per column - Building 'B'.
 5. Tapering: One-third, two-thirds entasis.
 6. Texture: Smooth.
 7. Split Columns: Permacast columns will wrap around steel columns.
- B. Capitals and Bases:
 1. Capital: Tuscan.
 2. Base: Tuscan.

2.3 ACCESSORY MATERIALS

- A. Construction Adhesive: Non-acetone based exterior grade.
 1. Use at top and bottom of shaft.
 2. Use at top of cap and bottom of base prior to nailing or screwing to soffit and substrate.
- B. Molding for Columns:
 1. 3/4 inches (19 mm) deep by 1 5/16 inches (33.3 mm) wide; 10 feet (3048 mm) long panel. (54505)
- C. Hardware:
 1. Bottom Anchors: Corner irons.

2. Anchor Fasteners: Deck screws.
3. Anchor Fasteners: Concrete anchors.
4. Cap and Base Fasteners: Screws.
5. Molding Fasteners: Screws.

2.4 FINISH

- A. Primer:
 1. Latex Based Primer: One light, even coat of top quality exterior latex primer.
- B. Finish Coat:
 1. Latex Based Finish: Three light, even coats of high quality exterior latex paint.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Do not begin installation until substrates have been properly prepared.
- B. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.
- C. Check opening height before ordering

columns. 3.2 PREPARATION

- A. Clean surfaces thoroughly prior to installation.
- B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.
- C. If attaching handrails or corner iron to column, pre-drill holes before applying screws.

3.3 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Plumb and level, with 100 percent of bottom contacting substrate and 75 percent of top contacting soffit. Center load over shaft and evenly distribute around bearing surface.

3.4 PROTECTION

- A. Protect installed products until completion of project.
- B. Touch-up, repair or replace damaged products before Substantial Completion.

- - - E N D - - -

THIS PAGE INTENTIONALLY LEFT BLANK

SECTION 06 61 42
ARCHITECTURAL WOOD COLUMNS

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Round columns, capitals, and bases.
- B. Materials for column protection.

1.2 RELATED SECTIONS

- A. Section 06 10 00 - Rough Carpentry: Wood framing.
- B. Section 06 61 41 - Architectural Composite

Columns. 1.3 SUBMITTALS

- A. Submit under provisions of Section 01 30 00.
- B. Product Data: Manufacturer's data sheets on each product to be used, including:
 - 1. Preparation instructions and recommendations.
 - 2. Storage and handling requirements and recommendations.
 - 3. Installation methods.
- C. Shop Drawings: For custom products, show dimensions, configuration, and anchorages.

1.4 DELIVERY, STORAGE, AND HANDLING

- A. Store columns in a dry, well ventilated area. Protect from moisture, weather, or extreme heat.
- B. Store products in manufacturer's unopened packaging until ready for installation.
- C. Store and dispose of solvent-based materials, and materials used with solvent-based materials, in accordance with requirements of local authorities having jurisdiction.

1.5 PROJECT CONDITIONS

- A. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's absolute limits.

1.6 WARRANTY

- A. Wood Columns: Provide manufacturer's warranty that columns are free of defects in material or workmanship for one year from date of shipment; comply with manufacturer's conditions for warranty including:
 - 1. Storage prior to installation.
 - 2. Installation.
 - 3. Protection from elements.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Basis-of-Design Manufacturer: HB&G; P.O. Box 589, Troy, AL 36081. ASD. Tel: (334) 566-5000. Fax: (334) [566-4629](tel:566-4629). www.hbgcolumns.com
- B. Provide product by manufacturer indicated or approved

equal. 2.2 ROUND COLUMNS

- A. Round Columns: Load-bearing; tongue and groove assembly; finish sanded.
 - 1. Stock Tapering: Continuous.
 - 2. Height: 9 feet (2743 mm).
 - 3. Size: 18 inches (457 mm) diameter; load limit: 14,000 pounds (6350 kg) per column.
 - 4. Texture: Smooth.
 - 5. Wood Species: Pine.
- B. Capitals:
 - 1. Style: Tuscan.
 - 2. Material: Wood.
- C. Bases:
 - 1. Style: Tuscan.
 - 2. Base (torus): Wood.

2.3 ACCESSORY MATERIALS

- A. Finish:
 - 1. Primer: As recommended by manufacturer of top coat.
 - 2. Top Coat: Two coats acrylic-latex paint.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Do not begin installation until substrates have been properly prepared.
- B. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

3.2 PREPARATION

- A. Check for level substrate.
- B. Clean surfaces thoroughly prior to installation.
- C. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions. 3.3

INSTALLATION

- A. Install in accordance with manufacturer's instructions and as required to avoid voiding manufacturer's warranty.
- B. Install columns level and plumb. If surface is not level, columns must be shimmed to level.
- C. Exterior applications: Paint inside of column with protective coating; apply minimum 4 feet (1219 mm) into shaft.
- D. Prime bottom and top ends of shaft with specified primer.
- E. Prime and finish outside of shaft with specified finish system.
- F. Maintain vent spaces in capital and base open to free flowing air. 3.4 PROTECTION

- A. Protect installed products until completion of project.
- B. Touch-up, repair or replace damaged products before Substantial Completion.

- - - E N D - - -

THIS PAGE INTENTIONALLY LEFT BLANK

**SECTION 07 11 13
BITUMINOUS DAMPPROOFING**

PART 1 - GENERAL

1.1 DESCRIPTION:

This section specifies materials and workmanship for bituminous dampproofing on concrete and masonry surfaces.

1.2 SUBMITTALS:

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Manufacturer's Literature and Data:
 - 1. Product description.
 - 2. Application instructions.

1.3 APPLICABLE PUBLICATIONS:

- A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.
- B. American Society for Testing and Materials (ASTM):
 - D226-06 Asphalt-Saturated Organic Felt Used in Roofing
and Waterproofing
 - D449-03(R2008) Asphalt Used in Dampproofing and Waterproofing
 - D1227-95(R2007) Emulsified Asphalt Used as a Protective Coating
for Roofing

PART 2 - PRODUCTS

2.1 ASPHALT (HOT APPLIED):

ASTM D449, Type I.

2.2 ASPHALT SATURATED FELT:

ASTM D226, Type I, 7 kg (15 pound).

2.3 ASPHALT EMULSION (COLD APPLIED):

ASTM D1227, Type III (spray grade)

PART 3 - EXECUTION

3.1 SURFACE PREPARATION:

- A. Surfaces to receive dampproofing shall be clean and smooth.
- B. Remove foreign matter, loose particles of mortar or other cementitious droppings.
- C. Clean and wash soil or dirt particles from surface.
- D. Remove free water; surfaces may remain damp.

3.2 APPLICATION:

- A. Comply with Manufacturer written instructions for methods and rates of dampproofing application, cleaning and installation of any protection course.
- B. Apply each coat at the rate of not less than 1 L/m² (2-1/2 gallons per 100 square feet) and allow not less than 24 hours drying time after application.

3.3 LOCATION:

- A. Apply to vertical surfaces on below grade concrete bearing walls. Extend protection full height from footing to 6" below top of back fill. CW/Masonry work and civil.

- - - E N D - - -

**SECTION 07 13 52
MODIFIED BITUMINOUS SHEET WATERPROOFING**

PART 1 - GENERAL

1.1 DESCRIPTION:

This section specifies modified bituminous sheet material used for exterior below grade waterproofing.

1.2 MANUFACTURER'S QUALIFICATIONS:

A. Approval by COTR is required of products and services of proposed manufacturers, and installers, and will be based upon submission by Contractor that:

1. Manufacturer regularly and presently manufactures bituminous sheet waterproofing as one of its principal products.
2. Installer has technical qualifications, experience, trained personnel and facilities to install specified items.
3. Manufacturer's product submitted has been in satisfactory and efficient operation on three similar installations for at least three years.
4. Submit list of installations, include name and location of project and name of owner.

1.3 SUBMITTALS:

A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

B. Manufacturer's Literature and Data:

1. Bituminous sheet.
2. Primer.
3. Mastic.
4. Protection material, temporary and permanent.
5. Printed installation instructions for conditions

specified. 1.4 PRODUCT DELIVERY, STORAGE AND HANDLING:

A. Deliver materials to job in manufacturer's original unopened container.

B. Do not store material in areas where temperature is lower than 10 degrees C (50 degrees F,) or where prolonged temperature is above 32 degrees C (90 degrees F).

1.5 ENVIRONMENTAL REQUIREMENTS:

Ambient Surface and Material Temperature: Not less than 4 degrees C (40 degrees F), during application of waterproofing.

1.6 WARRANTY:

Warrant bituminous sheet waterproofing installation against moisture leaks and subject to terms of "Warranty of Construction", FAR clause 52.246-21, except that warranty period is two years.

1.7 APPLICABLE PUBLICATIONS:

- A. Publications listed below form a part of this specification to the extent referenced. Publications are referenced by basic designation only.
- B. Federal Specifications (Fed. Spec.):
UU-B-790ABuilding Paper, Vegetable Fiber: (Kraft, Water-INT AMD 1 Proof, Water Repellent and Fire Resistant)
- C. American Society for Testing and Materials (ASTM):
C578-10Rigid Cellular Polystyrene Thermal Insulation
D41-11Asphalt Primer Used in Roofing, Dampproofing and Waterproofing
D2822-05Asphalt Roof Cement
D6380-03(R2009)Asphalt Roll Roofing (Organic Felt)
- D. American Hardboard Association (AHA):
A135.4-1995 Basic Hardboard

PART 2 - PRODUCTS**2.1 BITUMINOUS SHEET:**

- A. Cold applied waterproofing membrane composed primarily of modified bituminous material prefabricated in sheet form designed for below grade exterior and split slab waterproofing. Sheet reinforced with fibers at manufacturer's option.
- B. Thickness of Bituminous Sheet: 1.5 mm (60 mils), plus or minus 0.13 mm (5 mils), and bonded to a 0.1 mm (4 mil) thick plastic sheet.
- C. Provide with a release sheet to prevent bonding of bituminous sheet to itself.

2.2 PRIMER:

- A. Furnished by manufacturer of bituminous sheet as required for particular application in accordance with sheet manufacturer's instructions.
- B. Primer: ASTM D41.

2.3 PROTECTION MATERIAL:

- A. Polystyrene: ASTM C578, Type I or VIII, 26 mm (1-inch) minimum thickness.
- B. Hardboard: PS-58, Service Type, 6 mm (1/4-inch) thick.

2.4 PATCHING COMPOUND:

A factory prepared, non-shrinking, fast setting, cementitious adhesive compound containing no ferrous metal or oxide.

PART 3 - EXECUTION

3.1 PREPARATION:

A. Surface Condition:

1. Before applying waterproofing materials, ensure concrete surfaces are fully cured, smooth, clean, dry, and free from high spots, depressions, loose and foreign particles and other deterrents to adhesion.
2. Fill voids, joints, and cracks with patching compound.

B. Concrete surfaces cured a minimum of seven days, free from release agents, concrete curing agents, and other contaminants.

3.2 APPLICATION:

A. Priming:

1. Prime concrete surfaces.
2. Application method, amount of primer and condition or primer before installation of bituminous sheet as recommended by primer manufacturer.
3. Reprime when required in accordance with manufacturer's instructions.

B. Bituminous Sheet Installation:

1. Remove release sheet prior to application.
2. Lay bituminous sheet from low point to high point so that laps shed water.
3. Treat expansion, construction and control joints and evident working cracks as expansion joints. Apply bituminous sheet in double thickness over joint by first applying a strip of bituminous sheet not less than 200 mm (8 inches) wide, centered over joint.
4. Lap seams not less than 50 mm (2 inches).
5. Lay succeeding sheet with laps, and roll or press into place.
6. Repair misaligned or inadequately lapped seams in accordance with manufacturer's instructions.
7. Seal seams and terminations in accordance with sheet manufacturer's instructions.

C. Corner Treatment:

1. At inside and outside corners apply double cover using an initial strip not less than 280 mm (11 inches) wide, centered along axis of corner.
2. Cover each strip completely by the regular application of bituminous sheet.
3. Provide a fillet or cant on inside corners.
4. Form cants using patching compound
5. Do not use wood, fiber, and insulating materials for cants.

D. Projection Treatment:

1. Apply a double layer of bituminous sheet around pipes and similar projections at least 150 mm (6 inches) wide.

3.3 PROTECTION:

- A. Protect bituminous sheet before backfill or wearing courses are placed.
- B. Install protection material and hold in place in accordance with instructions of manufacturer of waterproofing materials.

C. Permanent Protection:

1. Vertical Surfaces:
 - a. Install polystyrene material.
 - b. If recommended by manufacturer, provide hardboard protection over polystyrene prior to backfill.
 - c. Extend protection full height from footing to top of backfill.

D. Temporary Protection:

When waterproofing materials are subjected to damage by sunlight and can not be immediately protected as specified, protect waterproofing materials by waterproof building paper or suitable coating approved by manufacturer of waterproofing system used.

3.4 PATCHING:

Repair tears, punctures, air blisters, and inadequately lapped seams, in accordance with manufacturer's instructions before protection course is applied.

3.5 INSPECTION:

Do not cover waterproofed surfaces by other materials or backfill until work is approved by COTR.

- - - E N D - - -

SECTION 07 19 00
WATER REPELLENTS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes penetrating water-repellent treatments for the following vertical surfaces:
1. Precast concrete.
 2. Clay brick masonry.

1.2 SUBMITTALS

- A. Product Data: For each type of product indicated.

1.3 QUALITY ASSURANCE

- A. Preinstallation Conference: Conduct conference at Project site.

PART 2 - PRODUCTS

2.1 PENETRATING WATER REPELLENTS

- A. For Precast Concrete: Silane, Penetrating Water Repellent: Clear, containing 20 percent or more solids of alkyltrialkoxysilanes; with alcohol, mineral spirits, water, or other proprietary solvent carrier; and with 400 g/L or less of VOCs.
1. Products: Subject to compliance with requirements, provide the following product or an approved equivalent product.
 - a. BASF Construction Chemicals, LLC; Enviroseal 20.
- B. For Clay Brick Masonry: Silane/Siloxane-Blend, Penetrating Water Repellent: Clear, silane and siloxane blend with 400 g/L or less of VOCs.
1. Products: Subject to compliance with requirements, provide the following product or an approved equivalent product:
 - a. BASF Construction Chemicals, LLC; Enviroseal Double 7 for Brick.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Applicator present, for compliance with requirements and conditions affecting performance of the Work.
1. Verify that surfaces are clean and dry according to water-repellent manufacturer's requirements. Check moisture content in representative locations by method recommended by manufacturer.
 2. Inspect for previously applied treatments that may inhibit penetration or performance of water repellents.

3. Verify that there is no efflorescence or other removable residues that would be trapped beneath the application of water repellent.
 4. Verify that required repairs are complete, cured, and dry before applying water repellent.
- B. Test pH level according to water-repellent manufacturer's written instructions to ensure chemical bond to silica-containing or siliceous minerals.

3.2 PREPARATION

- A. Cleaning: Before application of water repellent, clean substrate of substances that could impair penetration or performance of product according to water-repellent manufacturer's written instructions.
- B. Coordination with Mortar Joints: Do not apply water repellent until pointing mortar for joints adjacent to surfaces receiving water-repellent treatment has been installed and cured.
- C. Coordination with Sealant Joints: Do not apply water repellent until sealants for joints adjacent to surfaces receiving water-repellent treatment have been installed and cured.
1. Water-repellent work may precede sealant application only if sealant adhesion and compatibility have been tested and verified using substrate, water repellent, and sealant materials identical to those required.

3.3 APPLICATION

- A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect the substrate before application of water repellent and to instruct Applicator on the product and application method to be used.
- B. Apply a heavy-saturation coating of water repellent, on surfaces indicated for treatment, using low-pressure spray to the point of saturation. Remove excess material; do not allow material to puddle beyond saturation. Comply with manufacturer's written instructions for application procedure unless otherwise indicated.
1. Precast Concrete: At Contractor's option, first application of water repellent on units may be completed before installing them. Mask mortar and sealant bond surfaces to prevent water repellent from migrating onto joint surfaces.
- C. Apply a second saturation coating, repeating first application. Comply with manufacturer's written instructions for limitations on drying time between coats and after rainstorm wetting of surfaces

between coats. Consult manufacturer's technical representative if written instructions are not applicable to Project conditions.

3.4 CLEANING

- A. Immediately clean water repellent from adjoining surfaces and surfaces soiled or damaged by water-repellent application as work progresses. Correct damage to work of other trades caused by water-repellent application.
- B. Comply with manufacturer's written cleaning instructions.

- - - E N D - - -

THIS PAGE INTENTIONALLY LEFT BLANK

SECTION 07 21 13
THERMAL INSULATION

PART 1 - GENERAL

1.1 DESCRIPTION:

- A. This section specifies thermal and acoustical insulation for buildings.
- B. Acoustical insulation is identified by thickness and words "Sound Batt Insulation".

1.2 RELATED WORK

- A. Insulation in connection with roofing and waterproofing: Section 07 22 00, ROOF AND DECK INSULATION.
- B. Safing insulation: Section 07 84 00, FIRESTOPPING.

1.3 SUBMITTALS:

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Manufacturer's Literature and Data:
 - 1. Insulation, each type used
 - 2. Adhesive, each type used.
 - 3. Tape
- C. Certificates: Stating the type, thickness and "R" value (thermal resistance) of the insulation to be installed.

1.4 STORAGE AND HANDLING:

- A. Store insulation materials in weathertight enclosure.
- B. Protect insulation from damage from handling, weather and construction operations before, during, and after installation.

1.5 APPLICABLE PUBLICATIONS:

- A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by basic designation only.
- B. American Society for Testing and Materials (ASTM):
 - C270-08Mortar for Unit Masonry
 - C516-08 Vermiculite Loose Fill Thermal Insulation
 - C549-06 Perlite Loose Fill Insulation
 - C552-07 Cellular Glass Thermal Insulation.
 - C553-08 Mineral Fiber Blanket Thermal Insulation for
Commercial and Industrial Applications
 - C578-08 Rigid, Cellular Polystyrene Thermal Insulation
 - C591-08 Unfaced Preformed Rigid Cellular
Polyisocyanurate Thermal Insulation

- C612-04 Mineral Fiber Block and Board Thermal Insulation
- C665-06 Mineral Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing
- C728-05 Perlite Thermal Insulation Board
- C954-07 Steel Drill Screws for the Application of Gypsum Panel Products or Metal Plaster Base to Steel Studs From 0.033 (0.84 mm) inch to 0.112 inch (2.84 mm) in thickness
- C1002-07 Steel Self-Piercing Tapping Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Wood Studs or Steel Studs
- D312-00(R2006) Asphalt Used in Roofing
- E84-08 Surface Burning Characteristics of Building Materials
- F1667-05 Driven Fasteners: Nails, Spikes and Staples.

PART 2 - PRODUCTS

2.1 INSULATION - GENERAL:

- A. Where thermal resistance ("R" value) is specified or shown for insulation, the thickness shown on the drawings is nominal. Use only insulation with actual thickness that is not less than that required to provide the thermal resistance specified.
- B. Where "R" value is not specified for insulation, use the thickness shown on the drawings.
- C. Where more than one type of insulation is specified, the type of insulation for each use is optional, except use only one type of insulation in any particular area.
- D. Insulation Products shall comply with following minimum content standards for recovered materials:

Material Type	Percent by Weight
Polyisocyanurate/polyurethane	
Rigid foam	9 percent recovered material
Glass fiber reinforced	6 percent recovered material

The minimum-content standards are based on the weight (not the volume) of the material in the insulating core only.

2.2 EXTERIOR CAVITY WALL INSULATION:

- A. Polyurethane or Polyisocyanurate Board: ASTM C591, Type I, faced with a vapor retarder having a perm rating of not more than 0.5.

2.3 PERIMETER INSULATION IN CONTACT WITH SOIL:

- A. Polystyrene Board: ASTM C578, Type IV, V, VI, VII, or IX where covered by soil or concrete.
- B. Cellular Glass Block: ASTM C552, Type I or

IV. 2.4 EXTERIOR FRAMING OR FURRING INSULATION:

- A. Batt or Blanket: Optional.
- B. Mineral Fiber: ASTM C665, Type II, Class C, Category I where framing is faced with gypsum board.
- C. Mineral Fiber: ASTM C665, Type III, Class A where framing is not faced with gypsum board.

2.5 ACOUSTICAL INSULATION:

- A. Mineral Fiber Batt or Blankets: ASTM C665. Maximum flame spread of 25 and smoke development of 450 when tested in accordance with ASTM E84.
 - B. Thickness as shown; of widths and lengths to fit tight against framing.
- 2.6 INSULATION AT HEADERS (SPRAY POLYURETHANE FOAM INSULATION):**

- A. Closed-Cell Polyurethane Foam Insulation: ASTM C 1029, Type II, with maximum flame-spread and smoke-developed indexes of 75 and 450, respectively, per ASTM E 84.
- B. Minimum density of 1.5 lb/cu. ft. (24 kg/cu. m), thermal resistivity of 6.2 deg F x h x sq. ft./Btu x in. at 75 deg F (43 K x m/W at 24 deg C).

2.7 FASTENERS:

- A. Staples or Nails: ASTM F1667, zinc-coated, size and type best suited for purpose.
- B. Screws: ASTM C954 or C1002, size and length best suited for purpose with washer not less than 50 mm (two inches) in diameter.
- C. Impaling Pins: Steel pins with head not less than 50 mm (two inches) in diameter with adhesive for anchorage to substrate. Provide impaling pins of length to extend beyond insulation and retain cap washer when washer is placed on the pin.

2.8 ADHESIVE:

- A. As recommended by the manufacturer of the insulation.
- B. Asphalt: ASTM D312, Type III or IV.
- C. Mortar: ASTM C270, Type 0.

2.9 TAPE:

- A. Pressure sensitive adhesive on one face.
- B. Perm rating of not more than

0.50. PART 3 - EXECUTION**3.1 INSTALLATION - GENERAL**

- A. Install insulation with the vapor barrier facing the heated side, unless specified otherwise.
- B. Install rigid insulating units with joints close and flush, in regular courses and with cross joints broken.
- C. Install batt or blanket insulation with tight joints and filling framing void completely. Seal cuts, tears, and unlapped joints with tape.
- D. Fit insulation tight against adjoining construction and penetrations, unless specified otherwise.

3.2 MASONRY CAVITY WALLS:

- A. Bond polystyrene board to surfaces with adhesive or Portland cement mortar mixed and applied in accordance with recommendations of insulation manufacturer.

3.3 PERIMETER INSULATION:

- A. Vertical insulation:
 - 1. Fill joints of insulation with same material used for bonding.
 - 2. Bond polystyrene board to surfaces with adhesive or Portland cement mortar mixed and applied in accordance with recommendations of insulation manufacturer.
 - 3. Bond cellular glass insulation to surfaces with hot asphalt or adhesive cement.
- B. Horizontal insulation under concrete floor slab:
 - 1. Lay insulation boards and blocks horizontally on level, compacted and drained fill.
 - 2. Extend insulation from foundation walls towards center of building not less than 600 mm (24 inches) or as shown.

3.4 EXTERIOR FRAMING OR FURRING BLANKET INSULATION:

- A. Pack insulation around door frames and windows and in building expansion joints, door soffits and other voids. Pack behind outlets around pipes, ducts, and services encased in walls. Open voids are not permitted. Hold insulation in place with pressure sensitive tape.
- B. Lap vapor retarder flanges together over face of framing for continuous surface. Seal all penetrations through the insulation.

- C. Fasten blanket insulation between metal studs or framing and exterior wall furring by continuous pressure sensitive tape along flanged edges.
- E. Attic Insulation: Place mineral fiber blankets above structural deck with vapor barrier facing the heated side.
- F. Ceiling Insulation and Soffit Insulation:
 - 1. In areas where suspended ceilings adjoin areas without suspended ceilings, install either blanket, batt, or mineral fiberboard extending from the suspended ceiling to underside of deck or slab above. Secure in place to prevent collapse or separation of hung blanket, batt, or board insulation and maintain in vertical position. Secure blanket or batt with continuous cleats to structure above.

3.5 ACOUSTICAL INSULATION:

- A. Fasten blanket insulation between metal studs and wall furring with continuous pressure sensitive tape along edges or adhesive.
- B. Pack insulation around door frames and windows and in cracks, expansion joints, control joints, door soffits and other voids. Pack behind outlets, around pipes, ducts, and services encased in wall or partition. Hold insulation in place with pressure sensitive tape or adhesive.
- C. Do not compress insulation below required thickness except where embedded items prevent required thickness.

3.6 HEADER INSULATION:

- A. Install insulation in header voids and cavity spaces where required to prevent gaps in insulation. Apply according to manufacturer's written instructions.

- - - E N D - - -

THIS PAGE INTENTIONALLY LEFT BLANK

SECTION 07 25 00
WEATHER BARRIERS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
1. Weather Barrier Membrane.
 2. Seam Tape.
 3. Flashing.
 4. Fasteners.

1.2 SUBMITTALS

- A. Submit in accordance with Section 01 33 23 SHOP DRAWINGS, PRODUCT DATA AND SAMPLES.
- B. Product Data: For each type of product.

1.3 WARRANTY

- A. Weather Barrier Manufacturer's warranty for weather barrier for a period of ten years from date of substantial completion.

1.4 APPLICABLE PUBLICATIONS

- A. ASTM International
1. ASTM C 920; Standard Specification for Elastomeric Joint Sealants.
 2. ASTM C 1193; Standard Guide for Use of Joint Sealants.
 3. ASTM D 882; Test Method for Tensile Properties of Thin Plastic Sheeting.
 4. ASTM D 1117; Standard Guide for Evaluating Non-woven Fabrics.
 5. ASTM E 84; Test Method for Surface Burning Characteristics of Building Materials
 6. ASTM E 96; Test Method for Water Vapor Transmission of Materials.
 7. ASTM E 1677; Specification for Air Retarder Material or System for Framed Building Walls.

PART 2 - PRODUCTS

2.1 WATER-RESISTIVE BARRIER

- A. Building Wrap: ASTM E 1677, Type I air barrier; with flame-spread and smoke-developed indexes of less than 25 and 450, respectively, when tested according to ASTM E 84; UV stabilized; and acceptable to authorities having jurisdiction.
1. Basis-of-Design Product: E.I. Du Pont De Nemours and Company, High Performance, Flash Spun-Bonded Olefin, Non-Woven, Non-

Perforated, Secondary Weather Barrier "DuPont Tyvek→Commercial Wrap→and related assembly components.

- a. Or approved equal.
 2. Coordinate permeance value retained or inserted in "Water-Vapor Permeance" Subparagraph below with products retained. Consult manufacturers' literature.
 3. Water-Vapor Transmission: 30 Perms, when tested in accordance with ASTM E 96, Method B.
 4. Air Infiltration: >750 seconds, when tested in accordance with ASTM D 822, Method A.
- B. Building-Wrap Tape: Pressure-sensitive plastic tape recommended by building-wrap manufacturer for sealing joints and penetrations in building wrap.
- C. Fasteners: 1-5/8" rust resistant screw with 2-inch diameter plastic cap fasteners, or as recommended by weather barrier manufacturer.
- D. Adhesives: As recommended by the weather barrier manufacturer.

2.2 MISCELLANEOUS MATERIALS

- A. Flexible Flashing: Self-adhesive butyl rubber compound, bonded to a high-density polyethylene film, aluminum foil, or spunbonded polyolefin to produce an overall thickness of not less than 0.025 inch.
1. Products: Provide flashing products as manufactured by weather barrier manufacturer.
 2. Flexible membrane flashing for window openings and penetrations.
 3. Straight flashing for windows and doors and sealing penetrations such as masonry ties.
 4. Thru-wall flashing with integrated drip edge for flashing at changes in direction or elevation, and at transitions between different assembly materials.
 5. Preformed inside and outside corners, and end

dams. PART 3 - EXECUTION

3.1 WATER-RESISTIVE BARRIER INSTALLATION

- A. Cover sheathing with water-resistive barrier as follows:
1. Cut back barrier 1/2 inch on each side of the break in supporting members at expansion- or control-joint locations.
 2. Apply barrier to cover vertical flashing with a minimum 4-inch overlap unless otherwise indicated.
 3. Install weather barrier where indicated on Drawings in accordance with manufacturer's recommendations.

4. Install weather barrier prior to installation of windows and doors.
5. Start weather barrier at a building corner, leaving 6-12 inches of weather barrier extended beyond corner.
6. Install weather barrier in a horizontal manner starting at the lower portion of the wall surface with subsequent layers installed in shingling manner to overlap lower layers. Keep plumb and level.

B. Building Wrap: Comply with manufacturer's written instructions.

1. Seal seams, edges, fasteners, and penetrations with tape.
2. Extend into jambs of openings and seal corners with tape.

3.2 FLEXIBLE FLASHING INSTALLATION

A. Apply flexible flashing where indicated to comply with manufacturer's written instructions.

1. Lap seams and junctures with other materials at least 4 inches except that at flashing flanges of other construction, laps need not exceed flange width.
2. Lap flashing over water-resistive barrier at bottom and sides of openings.
3. Lap water-resistive barrier over flashing at heads of openings.

3.3 PROTECTION

A. Protect installed weather barrier from damage.

- - - E N D - - -

THIS PAGE INTENTIONALLY LEFT BLANK

SECTION 07 31 13 ASPHALT
SHINGLES

PART 1 - GENERAL

1.1 DESCRIPTION

This section specifies organic felt and fiberglass asphalt shingles.

1.2 RELATED WORK

A. Counterflashing and flashing of roof projections: Section 07 60 00,
FLASHING AND SHEET METAL.

1.3 SUMITTALS

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS,
PRODUCT DATA, AND SAMPLES.
- B. Samples: Shingles, each type, color and texture.
- C. Manufacturer's Literature and Data:
 - 1. Shingles, each type
 - 2. Installation instructions

1.4 DELIVERY AND STORAGE

- A. Deliver materials in manufacturer's unopened bundles or containers
with the manufacturer's brand and name clearly marked thereon.
 - B. Shingle bundle wrapping shall bear the label of Underwriters
Laboratories, Inc.
 - C. Store shingles in accordance with manufacturer's printed instructions.
Store roll goods on end in an upright position.
 - D. Keep materials dry, covered completely and protected from the
weather.
- 1.5 WARRANTY

A. Special Warranty: Manufacturer's standard or customized form, without
monetary limitation, in which manufacturer agrees to repair or
replace shingle roof that fails in materials or workmanship within
specified warranty period.

1. Warranty Period: 25 years from date of substantial
completion.

1.6 APPLICABLE PUBLICATIONS

- A. Publications listed below form a part of this specification to the
extent referenced. Publications are referenced in the text by the
basic designation only.
- B. American Society for Testing and Materials (ASTM):
D226-06 Asphalt-Saturated Organic Felt Used in Roofing
and Waterproofing

- D1970-08Self-Adhering Polymer Modified Bituminous Sheet
Materials Used as Steep Roofing Underlayment
for Ice Dam Protection
- D2178-04 Asphalt Glass Felt used in Roofing and
Waterproofing
- D3018-03 Class A Asphalt Shingles Surfaced with Mineral Granules
- D3462-07Asphalt, Shingles Made from Glass Felt and
Surfaced with Mineral Granules
- F1667-05Driven Fasteners: Nails, Spikes, and Staples
- C. Underwriter's Laboratories Inc. (UL):
- UL790-04 Fire Tests of Roof Covering

PART 2 - PRODUCTS

2.1 SHINGLES

- A. Class A: (Fire resistive), per UL790. ASTM D3018, Type I and ASTM 3462, square butt for a maximum exposure of 125 mm (5 inches), headlap minimum 50 mm (2 inches), wind resistant, self sealing. Minimum weight: 10.3 Kg/sqm (210 lbs/100sft).

B. Manufacturer: Provide Certainteed Hatteras - Outer Banks, or approved equal.

2.2 ROOFING NAILS

- A. ASTM F1667; Type I, Style 20, galvanized steel, deformed shanks, with heads 9.5 mm to 11 mm (3/8-inch to 7/16-inch) diameter.
- B. Use nails 32 mm (1-1/4 inches) long for shingles and 19 mm (3/4-inch long) for felt.

2.3 ROOFING FELT

- A. Fiberglass Felt: ASTM D2178.
- B. Organic Felt: ASTM D226, TYPE 1.
- C. Modified bitumen; ASTM D 1970.

PART 3 EXECUTION

3.1 PREPARATION

- A. Roof surfaces shall be sound, reasonably smooth and free from defects which would interfere with roofing installation.
- B. Roof accessories, vent pipes and other projections through the roof must be in place and roof flashing installed or ready for installation before laying shingles.

3.2 LAYING

- A. Lay felt under shingles over entire roof.
- B. Install asphalt felt underlayment, lapping a minimum of 100 mm (four inches) at ends, 50 mm (2 inches) at head and 300 mm (12 inches) over

ridge. Extend felt 13 mm (1/2-inch) beyond edges of roof. Nail felt 125 mm (five inches) on centers along laps.

- C. At eaves, install strip of 41 Kg (90 pound) mineral surface roll roofing not less than 460 mm (18 inches) wide and starter course of roof shingles with tabs reversed. Both shall overhang lower edge of roof 13 mm (1/2-inch).
- D. Lay shingles with maximum exposure of 125 mm (5 inches). Nail shingles in accordance with manufacturer's published directions.
- E. On slopes greater than 21" per foot, apply eight 1" diameter spots of asphalt roofing cement (ASTM 4586 Type II) under the shingle tab corner, according to application instructions provided by manufacturer.

3.3 METAL DRIP EDGES

- A. At rakes, install metal drip edges made of stainless steel specified under Section 07 60 00, FLASHING AND SHEET METAL. Apply the metal drip edge directly over the underlayment along the rakes.
- B. Secure metal drip edges with compatible nails spaced not more than 250 mm (10 inches) on center along the inner edges.

3.4 FLASHINGS

- A. Provide metal flashings specified under Section 07 60 00, FLASHING AND SHEET METAL at the intersections of roofs, adjoining walls, or projections through the deck such as chimneys and vent stacks. Give careful attention to the installation of all flashings.

3.5 RIDGE

- A. Bend each shingle lengthwise down center to provide equal exposure on each side of ridge. Beginning at one end of ridge, apply shingles with maximum 125 mm (5 inches) exposure.
- B. Secure each shingle with one nail on each side, 210 mm (8-1/2 inches) back from exposed end and one inch up from edge.

3.6 VALLEY FLASHING

- A. Install metal valley flashing shown and as specified under Section 07 60 00, FLASHING AND SHEET METAL.
- B. Secure valley flashing in accordance with shingle manufacturer's printed instructions.
- C. Expose flashing in open portion of valley a minimum of 125 mm (5 inches) and lap the shingles over the flashing a minimum of 125 mm (5 inches).

- - - E N D - - -

THIS PAGE INTENTIONALLY LEFT BLANK

SECTION 07 54 23
THERMOPLASTIC POLYOLEFIN (TPO) ROOFING

PART 1 GENERAL

1.1 DESCRIPTION

- A. Thermoplastic Polyolefin (TPO) sheet roofing adhered to roof deck.

1.2 RELATED WORK

- A. Treated wood framing, blocking, and nailers: Section 06 10 00, ROUGH CARPENTRY
- B. Sheet metal components and wind uplift requirements for roof-edge design: Section 07 60 00, FLASHING AND SHEET METAL.

1.3 APPLICABLE PUBLICATIONS

- A. Publications listed below form a part of this specification to the extent referenced. Publications are referenced in the text by the basic designation only. Editions of applicable publications current on date of issue of bidding documents apply unless otherwise indicated.
- B. American National Standards Institute/Single-Ply Roofing Institute (ANSI/SPRI):
ANSI/SPRI ES-1-03 Wind Design Standard for Edge Systems Used with Low Slope Roofing Systems.
- C. American Society of Civil Engineers/Structural Engineering Institute (ASCE/SEI):
ASCE/SEI-7-10 Minimum Design Loads for Buildings and Other Structures
- D. ASTM International (ASTM):
C67-09 Standard Test Methods for Sampling and Testing Brick and Structural Clay Tile
C140-09 Standard Test Methods for Sampling and Testing Concrete Masonry Units and Related Units
C1371-04 Standard Test Method for Determination of Emittance of Materials Near Room Temperature Using Portable Emissometers
C1549-04 Standard Test Method for Determination of Solar Reflectance Near Ambient Temperature Using a Portable Solar Reflectometer
D4263 Standard Test Method for Indicating Moisture in Concrete by the Plastic Sheet Method

- D4434-06 Standard Specification for Poly (Vinyl Chloride) Sheet Roofing
- D6878-08Standard Specification for Thermoplastic Polyolefin Based Sheet Roofing
- E108-10 Standard Test Methods for Fire Tests of Roof Coverings
- E408-71(R2008) Standard Test Methods for Total Normal Emittance of Surfaces Using Inspection-Meter Techniques
- E1918-06Standard Test Method for Measuring Solar Reflectance of Horizontal and Low-Sloped Surfaces in the Field
- E1980-01Standard Test Method for Measuring Solar Reflectance of Horizontal and Low-Sloped Surfaces in the Field
- E. American Society of Heating, Refrigeration, and Air Conditioning Engineers (ASHRAE)
- ASHRAE 90.1-2007 Energy Standard for Buildings Except Low-Rise Residential Buildings, Appendix f.
- F. Cool Roof Rating Council:
- CRRC-1Product Rating Program, www.coolroofs.org
- G. National Roofing Contractors Association: Roofing and Waterproofing Manual
- H. U.S. Department of Agriculture (USDA): USDA BioPreferred Catalog, www.biopreferred.gov
- I. U.S. Department of Energy (DoE): Roof Products Qualified Product List, www.energystar.gov

1.4 PERFORMANCE REQUIREMENTS

- A. Material Compatibility: Provide roofing materials that are compatible with one another under conditions of service and application required, as demonstrated by membrane roofing manufacturer based on testing and field experience.
- B. Roofing System Energy Performance Requirements: Provide a roofing system identical to components that that have been successfully tested by a qualified independent testing and inspecting agency to meet the following requirements:
1. Energy Performance, Energy Star: Provide roofing system that is listed on DOE's ENERGY STAR "Roof Products Qualified Product List" for low-slope roof products.

- C. General Performance: Installed membrane roofing and base flashing shall withstand specified uplift pressures, thermally induced movement, and exposure to weather without failure due to defective manufacture, fabrication, installation, or other defects in construction. Membrane roofing and base flashings shall remain water tight.
- D. Solar Reflectance Index: Not less than 78 when calculated according to ASTM E1980 based on testing identical products by a qualified testing agency.

1.5 QUALITY CONTROL

- A. Installer Qualifications:
 - 1. Licensed or approved in writing by manufacturer to perform work under warranty requirements of this Section.
 - 2. Employ full-time supervisors knowledgeable and experienced in roofing of similar types and scopes, and able to communicate with owner and workers.
- B. Inspector Qualifications: Inspection of work by third-party technical inspector or technical representative of manufacturer experienced in the installation and maintenance of the specified roofing system, qualified to perform roofing observation and inspection specified in Field Quality Control Article, to determine Installer's compliance with the requirements of this Project, and approved by the manufacturer to issue warranty certification. The Roofing Inspector shall be one of the following:
 - 1. An authorized full-time technical employee of the manufacturer, not engaged in the sale of products.
 - 2. An independent party certified as a Registered Roof Observer by the Roof Consultants Institute (RCI), may be retained by the Owner.
- C. Product/Material Requirements:
 - 1. Obtain products from single manufacturer or from sources recommended by manufacturer for use with roofing system and incorporated in manufacturer's warranty.
- D. Roofing system design standard requirements:
 - 1. Recommendations of the NRCA "Roofing and Waterproofing Manual" applicable to modified bituminous sheet roofing for storage, handling and application.
 - 2. Recommendations of FM Approvals 1-49 Loss Prevention Data Sheet for Perimeter Flashings.
 - 3. Recommendations of ANSI/SPRI ES-1 for roof edge design.

E. Pre-Roofing Meeting:

1. Upon completion of roof deck installation and prior to any roofing application, hold a pre-roofing meeting arranged by the Contractor and attended by the Roofing Inspector, Material Manufacturers Technical Representative, Roofing Applicator, Contractor, and COTR.
2. Discuss specific expectations and responsibilities, construction procedures, specification requirements, application, environmental conditions, job and surface readiness, material storage, and protection.
3. Inspect roof deck at this time to:
 - a. Verify that work of other trades which penetrates roof deck is completed.
 - b. Determine adequacy of deck anchorage, presence of foreign material, moisture and unlevel surfaces, or other conditions that would prevent application of roofing system from commencing or cause a roof failure.
 - c. Examine samples and installation instructions of manufacturer.

1.6 SUBMITTALS

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, SAMPLES.
- B. Product Data:
 1. Adhesive materials.
 2. Membrane sheet roofing and flashing membrane.
 3. Roofing cement.
 4. Roof walkway pads.
 5. Fastening requirements.
 6. Application instructions.
- C. Samples:
 1. 8-inch (203 mm) by 8-inch (203 mm) Sheet roofing, of color specified.
- D. Shop Drawings: Include plans, sections, details, and attachments.
 1. For roofing system.
- E. Manufacturer's Certificates:
 1. Signed by roofing manufacturer certifying that roofing system complies with requirements specified in "Performance Requirements" Article.
 - a. Submit evidence of compliance with performance requirements.
 2. Indicating compliance with energy performance requirement.
- F. Warranty: As specified.
- G. Documentation of supervisors' and inspectors' qualifications.

- H. Field reports of roofing inspector.
- I. Research evaluation reports.
- J. Contract Close-out Submittals:
 - 1. Maintenance Manuals.
 - 2. Warranty signed by installer and manufacturer.

1.7 DELIVERY, STORAGE AND HANDLING

- A. Comply with the recommendations of the NRCA "Roofing and Waterproofing Manual" applicable to single ply membrane roofing for storage, handling and installation.

1.8 WARRANTY

- A. Special Warranty: Manufacturer's standard or customized form, without monetary limitation, in which manufacturer agrees to repair or replace components of membrane roofing system that fail in materials or workmanship within specified warranty period.
 - 1. Warranty Period: 20 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 TPO MEMBRANE ROOFING

- A. TPO Sheet: ASTM D6878, internally fabric or scrim reinforced, 1.5 mm (60 mils) thick, uniform, flexible with internal fabric or scrim reinforced.
 - 1. Color: White.
 - 2. Manufacturers: Provide products by one of the following :
 - a. Carlisle SynTec Incorporated.
 - b. Firestone Building Products Company.
 - c. GAF Materials Corporation.
 - d. GenFlex Roofing Systems.
 - e. Johns Manville.
 - f. Stevens Roofing Systems; Division of JPS Elastomerics.

2.2 ACCESSORIES:

- A. Sheet Flashing: Manufacturer's standard sheet flashing of same material, type, reinforcement, thickness, and color as TPO sheet membrane.
- B. Bonding Adhesive: Manufacturer's standard.

- C. Metal Termination Bars: Manufacturer's standard, predrilled stainless-steel or aluminum bars, approximately 25 by 3 mm (1 by 1/8 inch) thick; with anchors.
- D. Metal Battens: Manufacturer's standard, aluminum-zinc-alloy-coated or zinc-coated steel sheet, approximately 25 mm wide by 1.3 mm (1 inch wide by 0.05 inch) thick, prepunched.
- E. Fasteners: Factory-coated steel fasteners and metal or plastic plates complying with FM Approvals 4470, designed for fastening membrane to substrate.
- F. Flexible Walkways: Factory-formed, nonporous, heavy-duty, slip-resisting, surface-textured walkway pads, approximately 5 mm (3/16 inch) thick, and acceptable to membrane roofing system manufacturer.
- G. Miscellaneous Accessories: Provide sealers, preformed flashings, preformed inside and outside corner sheet flashings, T-joint covers, lap sealants, termination reglets, and other accessories acceptable to manufacturer.
- H. Substrate Boards: ASTM C 1177/C 1177Mm, Glass-Mat, Water-Resistant Gypsum Substrate, Type 'X', 5/8" thick. Dens deck or approved equal, CW/Structural.

2.3 ROOF INSULATION:

- A. Polyisocyanurate Board Insulation: ASTM C 1289, Type II, Class 1, Grade 2, felt or glass-fiber mat facer on both major surfaces.
 - 1. R. Value as indicated on Drawings.
- B. Tapered Insulation: Provide factory-tapered insulation boards fabricated to slope of 1/4 inch per 12 inches (1:48) unless otherwise indicated.
- C. Provide preformed saddles, crickets, tapered edge strips, and other insulation shapes where indicated for sloping to drain. Fabricate to slopes indicated.
- D. INSULATION ACCESSORIES
 - 1. Fasteners: Factory-coated steel fasteners and metal or plastic plates complying with corrosion-resistance provisions in FM Approvals 4470, designed for fastening roof insulation to substrate, and acceptable to roofing system manufacturer.
 - 2. Insulation Adhesive: Insulation manufacturer's recommended cold-applied adhesive formulated to attach roof insulation to substrate or to another insulation layer.
 - 3. Cover Board: Cellulosic-Fiber Board Insulation: ASTM C208, Type II, Grade II, Fibrous Felted, rigid insulation of wood fiber or other

cellulosic-fiber and water-resistant binders, asphalt impregnated, and chemically treated for deterioration:

- a. Cover board to be a minimum 1/2" thick (13 mm) and compatible with roof membrane manufacturer to achieve indicated warranty.

2.3 ADHESIVE AND SEALANT MATERIALS:

- A. General: Adhesive and sealant materials recommended by roofing system manufacturer for intended use, identical to materials utilized in approved listed roofing system, and compatible with roofing membrane.
 1. Liquid-type auxiliary materials shall comply with VOC limits of authorities having jurisdiction.
 2. Adhesives and sealants that are not on the exterior side of weather barrier shall comply with the following limits for VOC content when calculated according to 40 CFR 59, Subpart D (EPA Method 24):
 - a. Gypsum Board and Panel Adhesives: 50 g/L.
 - b. Multipurpose Construction Adhesives: 70 g/L.
 - c. Single-Ply Roof Membrane Adhesives: 250 g/L.
 - d. Other Adhesives: 250 g/L.
 - e. Adhesive Primer for Plastic: 650 g/L
 - f. Single-Ply Roof Membrane Sealants: 450 g/L.
 - g. Nonmembrane Roof Sealants: 300 g/L.
 - h. Sealant Primers for Nonporous Substrates: 250 g/L.
 - i. Sealant Primers for Porous Substrates: 775 g/L.

PART 3 - EXECUTION

3.1 EXAMINATION:

- A. Examine substrates and conditions with roofing Installer and roofing inspector to verify compliance with project requirements and suitability to accept subsequent roofing work. Correct unsatisfactory conditions before proceeding with roofing work.
- B. Do not apply roofing if roof surface will be used for subsequent work platform, storage of materials, or staging or scaffolding will be erected thereon unless system is protected.

3.2 PREPARATION

- A. Complete roof deck construction prior to commencing roofing work:
 1. Install curbs, blocking, edge strips, nailers, cants, and other components where insulation, roofing, and base flashing is attached to, in place ready to receive insulation and roofing.

2. Complete deck and insulation to provide designed drainage to working roof drains.
 3. Document installation of related materials to be concealed prior to installing roofing work.
- B. Dry out surfaces, including the flutes of metal deck that become wet from any cause during progress of the work before roofing work is resumed. Apply materials to dry substrates.
 - C. Sweep decks to broom clean condition. Remove all dust, dirt or debris.
 - D. Remove projections that might damage materials.

3.3 TEMPORARY PROTECTION

- A. Install temporary protection at the end of day's work and when work is halted for an indefinite period or work is stopped when precipitation is imminent. Comply with approved temporary protection plan.
- B. Install temporary cap flashing over the top of base flashings where permanent flashings are not in place to provide protection against moisture entering the roof system through or behind the base flashing. Securely anchor in place to prevent blow off and damage by construction activities.
- C. Provide for removal of water or drainage of water away from the work.
- D. Provide temporary protection over installed roofing by means of duckboard walkways, plywood platforms, or other materials, as approved by COTR, for roof areas that are to remain intact, and that are subject to foot traffic and damage. Provide notches in sleepers to permit free drainage.

3.4 INSTALLATION, GENERAL

- A. NRCA Installation Standard: Install roofing system in accordance with applicable NRCA Manual Plates and NRCA recommendations.
- B. Manufacturer Recommendations: Comply with roofing system manufacturer's written installation recommendations.
- C. Coordination with related work: Coordinate roof operations with roof insulation and sheet metal work so that insulation and flashings are installed concurrently to permit continuous roofing operations.
- D. Installation Conditions:
 1. Apply dry roofing materials. Apply roofing work over dry substrates and materials.
 2. Apply materials within temperature range and surface and ambient conditions recommended by manufacturer.

3. Except for temporary protection, do not apply materials during damp or rainy weather, during excessive wind conditions, nor while moisture (dew, snow, ice, fog or frost) is present in any amount in or on the materials to be covered or installed:
 - a. Do not apply materials when the temperature is below 4 deg. C (40 deg. F).
 - b. Do not apply materials to substrate having temperature of 4 deg. C (40 deg. F) or less.

3.5 INSTALLATION OF TPO ROOFING

- A. Do not allow the membrane to come in contact with surfaces contaminated with asphalt, coal tar, oil, grease, or other substances which are not compatible with TPO.
- B. Install the membrane so the sheets run perpendicular to the long dimension of the insulation boards.
- C. Commence installation at the low point of the roof and work towards the high point. Lap the sheets so the flow of water is not against the edges of the sheet.
- D. Position the membrane so it is free of buckles and wrinkles.
- E. Roll sheet out on deck; inspect for defects as being rolled out and remove defective areas. Allow for relaxing before proceeding.
 1. Lap edges and ends of sheets 50 mm (two inches) or more as recommended by the manufacturer.
 2. Heat weld laps. Apply pressure as required. Seam strength of laps as required by ASTM D4434.
 3. Check seams to ensure continuous adhesion and correct defects.
 4. Finish edges of laps with a continuous beveled bead of sealant to sheet edges to provide smooth transition.
 5. Finish seams as the membrane is being installed (same day).
 6. Anchor perimeter to deck or wall as specified.
- F. Repair areas of welded seams where samples have been taken or marginal welds, bond voids, or skips occurs.
- G. Repair fishmouths and wrinkles by cutting to lay flat and installing patch over cut area extending 100 mm (four-inches) beyond cut.
- H. Membrane Perimeter Anchorage:
 1. Install metal fastening strip at the perimeter of each roof level, curb flashing, expansion joints and similar penetrations as indicated and in accordance with membrane manufacturer's instructions on top of roof membrane to deck or wall.
- I. Adhered System:

1. Apply adhesive in quantities required by roof membrane manufacturer.
 2. Fold sheet back on itself after rolling out and coat the bottom side of the membrane and the top of the deck with adhesive. Do not coat the lap joint area.
 3. After adhesive has set according to adhesive manufacturers application instruction, roll the membrane into the adhesive in a manner that minimizes voids and wrinkles.
 4. Repeat for other half of sheet. Cut voids and wrinkles to lay flat and clean for repair patch over cut area.
- J. Cover Board Installation: Install cover boards over insulation with long joints in continuous straight lines with end joints staggered between rows. Offset joints of insulation below a minimum of 6 inches (150 mm) in each direction, loosely butt cover boards together and fasten to roof deck.
1. Fasten cover boards to resist uplift pressure at corners, perimeter and field of roof.

3.6 INSTALLATION OF FLASHING

- A. Install flashings as the membrane is being installed. If the flashing can not be completely installed in one day, complete the installation until the flashing is in a watertight condition and provide temporary covers or seals.
- B. Flashing Roof Drains:
1. Install roof drain flashing as recommended by the membrane manufacturer, generally as follows:
 - a. Coordinate to set the metal drain flashing in asphalt roof cement, holding cement back from the edge of the metal flange.
 - b. Do not allow the roof cement to come in contact with the TPO roof membrane.
 - c. Adhere the TPO roof membrane to the metal flashing with the membrane manufacturer's recommended adhesive.
 2. Turn down the metal drain flashing and TPO roof membrane into the drain body and install clamping ring and strainer.
- C. Installing TPO Base Flashing and Pipe Flashing:
1. Install TPO flashing membranes to pipes, wall or curbs to a height not less than eight-inches above roof surfaces and 100 mm (four inches) on roof membrane.
 - a. Adhere flashing to pipe, wall or curb with adhesive.

- b. Form inside and outside corners of TPO flashing membrane in accordance with NRCA manual. Form pipe flashing in accordance with NRCA manual use pipe boot.
 - c. Lap ends not less than 100 mm (four inches).
 - d. Heat weld flashing membranes together and flashing membranes to roof membranes. Finish exposed edges with sealant as specified.
 - e. Install flashing membranes in accordance with NRCA manual.
2. Anchor top of flashing to walls or curbs with fasteners spaced not over 200 mm (eight inches) on centers. Use fastening strip on ducts. Use pipe clamps on pipes or other round penetrations.
 3. Apply sealant to top edge of flashing.
- D. Repairs to membrane and flashings:
1. Remove sections of TPO sheet roofing or flashing that is creased wrinkled or fishmouthed.
 2. Cover removed areas, cuts and damaged areas with a patch extending 100 mm (four inches) beyond damaged, cut, or removed area. Heat weld to roof membrane or flashing. Finish edge of lap with sealant as specified.

3.7 FLEXIBLE WALKWAYS

- A. Use factory-formed, non-porous, heavy-duty, slip resisting, surface-textured walkway pads, approximately 3/16 inch (5 mm) thick, and acceptable to membrane roofing system manufacturer.
- B. Heat weld walkway pads to substrate with compatible adhesive according to roofing system manufacturer's written instructions.
- D. Install walkway products in locations indicated on Drawings.

3.8 FIELD QUALITY CONTROL:

- A. Roofing Inspector: Owner may engage a qualified roofing inspector to perform roof tests and inspections and to prepare test reports.
- B. Final Roof Inspection: Arrange for roofing system manufacturer's technical personnel to inspect roofing installation on completion, refer to 1.5.B.
- C. Repair or remove and replace components of roofing work where test results or inspections indicate that they do not comply with specified requirements.
 1. Additional testing and inspecting, at Contractor's expense, will be performed to determine if replaced or additional work complies with specified requirements.

3.9 PROTECTING AND CLEANING

- A. Protect membrane roofing system from damage and wear during remainder of construction period.
- B. Correct deficiencies in or remove membrane roofing system that does not comply with requirements; repair substrates; and repair or reinstall membrane roofing system to a condition free of damage and deterioration at time of acceptance by Owner.
- C. Clean overspray and spillage from adjacent construction. Clean membrane and restore surface to like-new condition meeting solar reflectance requirements.

- - - E N D - - -

THIS PAGE INTENTIONALLY LEFT BLANK

**SECTION 07 60 00
FLASHING AND SHEET METAL**

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Formed sheet metal work for wall and roof flashing, copings, roof edge metal, fasciae and drainage specialties.

1.2 RELATED WORK

- A. Membrane base flashings and stripping: Section 07 54 23, THERMOPLASTIC POLYOLEFIN (TPO) ROOFING.
- B. Flashing components of factory finished roofing and wall systems: Division 07 roofing and wall system sections.
- C. Joint Sealants: Section 07 92 00, JOINT SEALANTS.
- D. Integral flashing components of manufactured roof specialties and accessories or equipment: Division 22, PLUMBING sections and Division 23 HVAC sections.
- E. Paint materials and application: Section 09 91 00, PAINTING.
- F. Flashing of Roof Drains: Section 22 14 00, FACILITY STORM DRAINAGE.

1.3 APPLICABLE PUBLICATIONS

- A. Publications listed below form a part of this specification to the extent referenced. Publications are referenced in the text by the basic designation only. Editions of applicable publications current on date of issue of bidding documents apply unless otherwise indicated.
- B. Aluminum Association (AA):
- | | | |
|-----------|-------|--|
| AA-C22A41 | ..... | Aluminum Chemically etched medium matte, with clear anodic coating, Class I Architectural, 0.7-mil thick |
| AA-C22A42 | ..... | Chemically etched medium matte, with integrally colored anodic coating, Class I Architectural, 0.7 mils thick |
| AA-C22A44 | ..... | Chemically etched medium matte with electrolytically deposited metallic compound, integrally colored coating Class I Architectural, 0.7-mil thick finish |
- C. American National Standards Institute/Single-Ply Roofing Institute (ANSI/SPRI):

- ANSI/SPRI ES-1-03 Wind Design Standard for Edge Systems Used with
Low Slope Roofing Systems
- D. American Architectural Manufacturers Association (AAMA):
- AAMA 620 Voluntary Specification for High Performance
Organic Coatings on Coil Coated Architectural
Aluminum
- AAMA 621 Voluntary Specification for High Performance
Organic Coatings on Coil Coated Architectural
Hot Dipped Galvanized (HDG) and Zinc-Aluminum
Coated Steel Substrates
- E. ASTM International (ASTM):
- A167-99(R2009) Stainless and Heat-Resisting Chromium-Nickel
Steel Plate, Sheet, and Strip
- A653/A653M-09 Steel Sheet Zinc-Coated (Galvanized) or Zinc
Alloy Coated (Galvanized) by the Hot- Dip
Process
- B32-08 Solder Metal
- B209-07 Aluminum and Aluminum-Alloy Sheet and Plate
- B370-09 Copper Sheet and Strip for Building
Construction
- D173-03 Bitumen-Saturated Cotton Fabrics Used in
Roofing and Waterproofing
- D412-06 Vulcanized Rubber and Thermoplastic Elastomers-
Tension
- D1187-97(R2002) Asphalt Base Emulsions for Use as Protective
Coatings for Metal
- D1784-08 Rigid Poly (Vinyl Chloride) (PVC) Compounds and
Chlorinated Poly (Vinyl Chloride) (CPVC)
Compounds
- D3656-07 Insect Screening and Louver Cloth Woven from
Vinyl-Coated Glass Yarns
- D4586-07 Asphalt Roof Cement, Asbestos Free
- F. Sheet Metal and Air Conditioning Contractors National Association
(SMACNA): Architectural Sheet Metal Manual.
- G. National Association of Architectural Metal Manufacturers (NAAMM):
- AMP 500-06 Metal Finishes Manual
- H. Federal Specification (Fed. Spec):
- A-A-1925A Shield, Expansion; (Nail Anchors)

UU-B-790A Building Paper, Vegetable Fiber

I. International Code Commission (ICC): International Building Code, Current Edition

1.4 PERFORMANCE REQUIREMENTS

- A. Wind Uplift Forces: Resist the following forces per FM Approvals 1-49:
1. Wind Zone 1: 0.48 to 0.96 kPa (10 to 20 lbf/sq. ft.): 1.92-kPa (40-lbf/sq. ft.) perimeter uplift force, 2.87-kPa (60-lbf/sq. ft.) corner uplift force, and 0.96-kPa (20-lbf/sq. ft.) outward force.
 2. Wind Zone 1: 1.00 to 1.44 kPa (21 to 30 lbf/sq. ft.): 2.87-kPa (60-lbf/sq. ft.) perimeter uplift force, 4.31-kPa (90-lbf/sq. ft.) corner uplift force, and 1.44-kPa (30-lbf/sq. ft.) outward force.
 3. Wind Zone 2: 1.48 to 2.15 kPa (31 to 45 lbf/sq. ft.): 4.31-kPa (90-lbf/sq. ft.) perimeter uplift force, 5.74-kPa (120-lbf/sq. ft.) corner uplift force, and 2.15-kPa (45-lbf/sq. ft.) outward force.
 4. Wind Zone 3: 2.20 to 4.98 kPa (46 to 104 lbf/sq. ft.): 9.96-kPa (208-lbf/sq. ft.) perimeter uplift force, 14.94-kPa (312-lbf/sq. ft.) corner uplift force, and 4.98-kPa (104-lbf/sq. ft.) outward force.
- B. Wind Design Standard: Fabricate and install copings and roof-edge flashings tested per ANSI/SPRI ES-1 to resist design pressure indicated on Drawings.

1.5 SUBMITTALS

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Shop Drawings: For all specified items, including:
1. Flashings
 2. Copings
 3. Cornices and Fascias
 4. Gutter and Conductors
 5. Expansion joints
 6. Scuppers
- C. Manufacturer's Literature and Data: For all specified items, including:
1. Two-piece counterflashing
 2. Thru wall flashing
 3. Nonreinforced, elastomeric sheeting
 4. Copper clad stainless steel
 5. Polyethylene coated copper

6. Bituminous coated copper
7. Copper covered paper

PART 2 - PRODUCTS

2.1 FLASHING AND SHEET METAL MATERIALS

- A. Stainless Steel: ASTM A167, Type 302B, dead soft temper.
- B. Copper ASTM B370, cold-rolled temper.
- C. Bituminous Coated Copper: Minimum copper ASTM B370, weight not less than 1 kg/m² (3 oz/sf). Bituminous coating shall weigh not less than 2 kg/m² (6 oz/sf); or, copper sheets may be bonded between two layers of coarsely woven bitumen-saturated cotton fabric ASTM D173. Exposed fabric surface shall be crimped.
- D. Copper Covered Paper: Fabricated of electro-deposit pure copper sheets ASTM B 370, bonded with special asphalt compound to both sides of creped, reinforced building paper, UU-B-790, Type I, style 5, or to a three ply sheet of asphalt impregnated creped paper. Grooves running along the width of sheet.
- E. Polyethylene Coated Copper: Copper sheet ASTM B370, weighing 1 Kg/m² (3 oz/sf) bonded between two layers of (two mil) thick polyethylene sheet.
- F. Aluminum Sheet: ASTM B209, alloy 3003-H14 except alloy used for color anodized aluminum shall be as required to produce specified color. Alloy required to produce specified color shall have the same structural properties as alloy 3003-H14.
- G. Nonreinforced, Elastomeric Sheeting: Elastomeric substances reduced to thermoplastic state and extruded into continuous homogenous sheet (0.056 inch) thick. Sheeting shall have not less than 7 MPa (1,000 psi) tensile strength and not more than seven percent tension-set at 50 percent elongation when tested in accordance with ASTM D412. Sheeting shall show no cracking or flaking when bent through 180 degrees over a 1 mm (1/32 inch) diameter mandrel and then bent at same point over same size mandrel in opposite direction through 360 degrees at temperature of -30°C (-20 °F).

2.2 FLASHING ACCESSORIES

- A. Solder: ASTM B32; flux type and alloy composition as required for use with metals to be soldered.

- B. Rosin Paper: Fed-Spec. UU-B-790, Type I, Grade D, Style 1b, Rosin-sized sheathing paper, weighing approximately 3 Kg/10 m²(6 lbs/100 sf).
- C. Bituminous Paint: ASTM D1187, Type I.
- D. Fasteners:
 - 1. Use copper, copper alloy, bronze, brass, or stainless steel for copper and copper clad stainless steel, and stainless steel for stainless steel and aluminum alloy. Use galvanized steel or stainless steel for galvanized steel.
 - 2. Nails:
 - a. Minimum diameter for copper nails: 3 mm (0.109 inch).
 - b. Minimum diameter for aluminum nails 3 mm (0.105 inch).
 - c. Minimum diameter for stainless steel nails: 2 mm (0.095 inch) and annular threaded.
 - d. Length to provide not less than 22 mm (7/8 inch) penetration into anchorage.
 - 3. Rivets: Not less than 3 mm (1/8 inch) diameter.
 - 4. Expansion Shields: Fed Spec A-A-1925A.
- E. Sealant: As specified in Section 07 92 00, JOINT SEALANTS for exterior locations.
- F. Insect Screening: ASTM D3656, 18 by 18 regular mesh.
- G. Roof Cement: ASTM D4586.

2.3 SHEET METAL THICKNESS

- A. Except as otherwise shown or specified use thickness or weight of sheet metal as follows:
- B. Concealed Locations (Built into Construction):
 - 1. Copper: 30g (10 oz) minimum 0.33 mm (0.013 inch thick).
 - 2. Stainless steel: 0.25 mm (0.010 inch) thick.
 - 3. Copper clad stainless steel: 0.25 mm (0.010 inch) thick.
 - 4. Galvanized steel: 0.5 mm (0.021 inch) thick.
- C. Exposed Locations:
 - 1. Copper: 0.4 Kg (16 oz).
 - 2. Stainless steel: 0.4 mm (0.015 inch).
 - 3. Copper clad stainless steel: 0.4 mm (0.015 inch).
- D. Thickness of aluminum is specified with each item.

2.4 FABRICATION, GENERAL

A. Jointing:

1. In general, copper, stainless steel and copper clad stainless steel joints, except expansion and contraction joints, shall be locked and soldered.
2. Jointing of copper over 0.5 Kg (20 oz) weight or stainless steel over 0.45 mm (0.018 inch) thick shall be done by lapping, riveting and soldering.
3. Joints shall conform to following requirements:
 - a. Flat-lock joints shall finish not less than 19 mm (3/4 inch) wide.
 - b. Lap joints subject to stress shall finish not less than 25 mm (one inch) wide and shall be soldered and riveted.
 - c. Unsoldered lap joints shall finish not less than 100 mm (4 inches) wide.
4. Flat and lap joints shall be made in direction of flow.
5. Edges of bituminous coated copper, copper covered paper, nonreinforced elastomeric sheeting and polyethylene coated copper shall be jointed by lapping not less than 100 mm (4 inches) in the direction of flow and cementing with asphalt roof cement or sealant as required by the manufacturer's printed instructions.
6. Soldering:
 - a. Pre tin both mating surfaces with solder for a width not less than 38 mm (1 1/2 inches) of uncoated copper, stainless steel, and copper clad stainless steel.
 - b. Wire brush to produce a bright surface before soldering lead coated copper.
 - c. Treat in accordance with metal producers recommendations other sheet metal required to be soldered.
 - d. Completely remove acid and flux after soldering is completed.

B. Expansion and Contraction Joints:

1. Fabricate in accordance with the Architectural Sheet Metal Manual recommendations for expansion and contraction of sheet metal work in continuous runs.
2. Space joints as shown or as specified.
3. Space expansion and contraction joints for copper, stainless steel, and copper clad stainless steel at intervals not exceeding 7200 mm (24 feet).

4. Space expansion and contraction joints for aluminum at intervals not exceeding 5400 mm (18 feet), except do not exceed 3000 mm (10 feet) for gravel stops and fascia-cant systems.
5. Fabricate slip-type or loose locked joints and fill with sealant unless otherwise specified.
6. Fabricate joint covers of same thickness material as sheet metal served.

C. Cleats:

1. Fabricate cleats to secure flashings and sheet metal work over 300 mm (12 inches) wide and where specified.
2. Provide cleats for maximum spacing of 300 mm (12 inch) centers unless specified otherwise.
3. Form cleats of same metal and weights or thickness as the sheet metal being installed unless specified otherwise.
4. Fabricate cleats from 50 mm (2 inch) wide strip. Form end with not less than 19 mm (3/4 inch) wide loose lock to item for anchorage. Form other end of length to receive nails free of item to be anchored and end edge to be folded over and cover nail heads.

D. Edge Strips or Continuous Cleats:

1. Fabricate continuous edge strips where shown and specified to secure loose edges of the sheet metal work.
2. Except as otherwise specified, fabricate edge strips or minimum 1.25 mm (0.050 inch) thick aluminum.
3. Use material compatible with sheet metal to be secured by the edge strip.
4. Fabricate in 3000 mm (10 feet) maximum lengths with not less than 19 mm (3/4 inch) loose lock into metal secured by edge strip.
5. Fabricate Strips for fascia anchorage to extend below the supporting wood construction to form a drip and to allow the flashing to be hooked over the lower edge at least 19 mm (3/4-inch).
6. Fabricate anchor edge maximum width of 75 mm (3 inches) or of sufficient width to provide adequate bearing area to insure a rigid installation using 1.6 mm (0.0625 inch) thick aluminum.

E. Drips:

1. Form drips at lower edge of sheet metal counter-flashings (cap flashings), fascias, wall copings, by folding edge back 13 mm (1/2 inch) and bending out 45 degrees from vertical to carry water away from the wall.
2. Form drip to provide hook to engage cleat or edge strip for fastening for not less than 19 mm (3/4 inch) loose lock where shown.

F. Edges:

1. Edges of flashings concealed in masonry joints opposite drain side shall be turned up 6 mm (1/4 inch) to form dam, unless otherwise specified or shown otherwise.
2. Finish exposed edges of flashing with a 6 mm (1/4 inch) hem formed by folding edge of flashing back on itself when not hooked to edge strip or cleat. Use 6 mm (1/4 inch) minimum penetration beyond wall face with drip for through-wall flashing exposed edge.

G. Metal Options:

1. Where options are permitted for different metals use only one metal throughout.
2. Stainless steel may be used in concealed locations for fasteners of other metals exposed to view.

2.5 FINISHES

- A. Use same finish on adjacent metal or components and exposed metal surfaces unless specified or shown otherwise.
- B. In accordance with NAAMM Metal Finishes Manual AMP 500, unless otherwise specified.
- C. Finish exposed metal surfaces as follows, unless specified otherwise:
 1. Aluminum:
 - a. Fluorocarbon Finish: AAMA 620, high performance organic coating.

2.6 THROUGH-WALL FLASHINGS

- A. Form through-wall flashing to provide a mechanical bond or key against lateral movement in all directions. Install a sheet having 2 mm (1/16 inch) deep transverse channels spaced four to every 25 mm (one inch), or ribbed diagonal pattern, or having other deformation unless specified otherwise.
 1. Fabricate in not less than 2400 mm (8 feet) lengths; 3000 mm (10 feet) maximum lengths.
 2. Fabricate so keying nests at overlaps.

- B. For Masonry Work When Concealed Except for Drip:
1. Either copper, stainless steel, or copper clad stainless steel.
 2. Form an integral dam at least 5 mm (3/16 inch) high at back edge.
 3. Form exposed portions of flashing with drip, approximately 6 mm (1/4 inch) projection beyond wall face.
- C. For Masonry Work When Exposed Edge Forms a Receiver for Counter Flashing:
1. Use same metal and thickness as counter flashing.
 2. Form an integral dam at least 5 mm (3/16 inch) high at back edge.
 3. Form exposed portion as snap lock receiver for counter flashing upper edge.
- D. Window Sill Flashing and Lintel Flashing:
1. Use either copper, stainless steel, copper clad stainless steel plane flat sheet, or nonreinforced elastomeric sheeting, bituminous coated copper, copper covered paper, or polyethylene coated copper.
 2. Fabricate flashing at ends with folded corners to turn up 5 mm (3/16 inch) in first vertical masonry joint beyond masonry opening.
 3. Turn up back edge as shown.
 4. Form exposed portion with drip as specified or receiver.
- E. Door Sill Flashing:
1. Where concealed, use either 0.5 Kg (20 oz) copper, 0.5 mm (0.018 inch) thick stainless steel, or 0.5 mm (0.018 inch) thick copper clad stainless steel.
 2. Where shown on drawings as combined counter flashing under threshold, sill plate, door sill, or where subject to foot traffic, use either 0.6 Kg (24 ounce) copper, 0.6 mm (0.024 inch) stainless steel, or 0.6 mm (0.024 inch) thick stainless steel.
 3. Fabricate flashing at ends to turn up 5 mm (3/16 inch) in first vertical masonry joint beyond masonry opening with folded corners.

2.7 COUNTERFLASHING (CAP FLASHING OR HOODS)

- A. Prefinished Aluminum 1.25 mm (0.051 inch) thick, unless specified otherwise.
- B. Fabricate to lap base flashing a minimum of 100 mm (4 inches) with drip:
1. Form lock seams for outside corners. Allow for lap joints at ends and inside corners.

2. In general, form flashing in lengths not less than 2400 mm (8 feet) and not more than 3000 mm (10 feet).
3. Two-piece, lock in type flashing may be used in-lieu-of one piece counter-flashing.
4. Manufactured assemblies may be used.
5. Where counterflashing is installed at new work use an integral flange at the top designed to be extended into the masonry joint or reglet in concrete.

C. Two-Piece Counterflashing:

1. Receiver to extend into masonry wall depth of masonry unit with back edge turned up 6 mm (1/4 inch) and exposed edge designed to receive and lock counterflashing upper edge when inserted.
2. Counterflashing upper edge designed to snap lock into receiver.

2.8 FASCIAS/SOFFITS

A. General:

1. Fabricate in lengths not less than 2400 mm (8 feet) long and maximum of 3000 mm (10 feet).
2. Fabricate internal and external corners as one-piece with legs not less than 600 mm (2 feet) or more than 1200 mm (4 feet) long.
3. Fabricate lower edge outward at an angle of 45 degrees to form drip and as fascia or as counter flashing as shown:
 - a. Fabricate of one-piece material of suitable width for fascia height of 250 mm (10 inch) maximum or counterflashing lap of not less than 100 mm (4 inch) over base flashing.
 - b. Fabricate bottom edge of formed fascia to receive edge strip.

B. Formed Flat Sheet Metal Fascia:

1. Fabricate as shown of 1.25 mm (0.050 inch) thick prefinished aluminum.
2. When fascia exceeds 150 mm (6 inches) in depth, form one or more horizontal stops not less than 13 mm (1/2 inch) high in the fascia.
3. Fabricate as two-piece fascia when fascia depth exceeds 250 mm (10 inches).
4. At joint between ends of sheets, provide a concealed clip soldered or welded near one end of each sheet to hold the adjoining sheet in lapped position. The clip shall be approximately 100 mm (4 inches) wide and shall be the full depth of the fascia less 25 mm (one inch)

thickness as the fascia.

5. Provide edge strip as specified with lower hooked edge bent outward at an angle of 45 degrees.

2.9 HANGING GUTTERS

- A. Fabricate gutters of not less than the following:
 1. 1.6 mm (0.0625 inch) thick prefinished aluminum.
- B. Fabricate hanging gutters in sections not less than 2400 mm (8 feet) long, except at ends of runs where shorter lengths are required.
- C. Building side of gutter shall be not less than 38 mm (1 1/2 inches) higher than exterior side.
- D. Gutter Bead: Stiffen outer edge of gutter by folding edge over approximately 19 mm (3/4 inch) toward roof and down approximately 19 mm (3/4 inch) unless shown otherwise.
- E. Gutter Spacers:
 1. Fabricate of same material and thickness as gutter.
 2. Fabricate 25 mm (one inch) wide strap and fasten to gutters not over 900 mm (36 inches) on center.
 3. Turn back edge up 25 mm (one inch) and lap front edge over gutter bead.
 4. Rivet and solder to gutter except rivet and seal to aluminum.
- F. Outlet Tubes:
 1. Form outlet tubes to connect gutters to conductors of same metal and thickness as gutters extend into the conductor 75 mm (3 inch).
Flange upper end of outlet tube 13 mm (1/2 inch).
 2. Lock and solder longitudinal seam except use sealant in lieu of solder with aluminum.
 3. Seal aluminum tube to gutter and rivet to gutter.
 4. Fabricate basket strainers of same material as gutters.
- G. Gutter Brackets:
 1. Fabricate of same metal as gutter.
 - a. 5 by 25 mm (3/16 by 1 inch) prefinished aluminum.
 2. Fabricate to gutter profile.
 3. Drill two 5 mm (3/16 inch) diameter holes in anchor leg for countersunk flat head screws.

2.10 CONDUCTORS (DOWNSPOUTS)

- A. Fabricate conductors of same metal and thickness as gutters in sections approximately 3000 mm (10 feet) long [with 19 mm (3/4 inch) wide flat locked seams].
 - 1. Fabricate open face channel shape with hemmed longitudinal edges.
- B. Fabricate elbows by mitering, riveting, and soldering except seal aluminum in lieu of solder. Lap upper section to the inside of the lower piece.
- C. Fabricate conductor brackets or hangers of same material as conductor, 2 mm (1/16 inch) thick by 25 mm (one inch) minimum width. Form to support conductors 25 mm (one inch) from wall surface in accordance with Architectural Sheet Metal Manual Plate 34, Design C for rectangular shapes and E for round shapes.
- D. Conductor Heads:
 - 1. Fabricate of same material as conductor.
 - 2. Fabricate conductor heads to not less than 250 mm (10 inch) wide by 200 mm (8 inch) deep by 200 mm (8 inches) from front to back.
 - 3. Form front and side edges channel shape not less than 13 mm (1/2 inch) wide flanges with edge hemmed.
 - 4. Slope bottom to sleeve to conductor or downspout at not less than 60 degree angle.
 - 5. Extend wall edge not less than 25 mm (one inch) above front edge.
 - 6. Solder joints for water tight assembly.
 - 7. Fabricate outlet tube or sleeve at bottom not less than 50 mm (2 inches) long to insert into conductor.

2.11 REGLETS

- A. Fabricate reglets of one of the following materials:
 - 1. Prefinished Aluminum 1.25 mm (0.051 inch) thick.
- B. Fabricate reglets for building into horizontal masonry mortar joints not less than 19 mm (3/4 inch) deep, nor more than 25 mm (one inch) deep.
- C. Fabricate mitered corners, fittings, and special shapes as may be required by details.
- D. Reglets for concrete may be formed to receive flashing and have a 10 mm (3/8 inch), 45 degree snap lock.

2.12 SCUPPERS

- A. Fabricate scuppers with minimum of 100 mm (4 inch) wide flange.
- B. Provide flange at top on through wall scupper to extend to top of base flashing.
- C. Fabricate exterior wall side to project not less than 13 mm (1/2 inch) beyond face of wall with drip at bottom outlet edge.
- D. Fabricate exterior wall flange for through wall scupper not less than 25 mm (one inch) wide on top and sides with edges hemmed.
- E. Fabricate scupper not less than 200 mm (8 inch) wide and not less than 125 mm (5 inch) high for through wall scupper.
- F. Seal joints watertight.

2.13 COPING

- A. Form of 1.6 mm (0.0625 inch) thick prefinished aluminum.
 1. Form lower-edge to sleeve to curb.
- B. Fabricate copings in sections not less than 2400 mm (8 feet) long, except at ends of runs where shorter lengths are required.
- C. Coping Cleat.
 1. Fabricate of same material and thickness as coping.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. General:
 1. Install flashing and sheet metal items as shown in Sheet Metal and Air Conditioning Contractors National Association, Inc., publication, ARCHITECTURAL SHEET METAL MANUAL, except as otherwise shown or specified.
 2. Apply Sealant as specified in Section 07 92 00, JOINT SEALANTS.
 3. Apply sheet metal and other flashing material to surfaces which are smooth, sound, clean, dry and free from defects that might affect the application.
 4. Remove projections which would puncture the materials and fill holes and depressions with material compatible with the substrate. Cover holes or cracks in wood wider than 6 mm (1/4 inch) with sheet metal compatible with the roofing and flashing material used.
 5. Coordinate with masonry work for the application of a skim coat of mortar to surfaces of unit masonry to receive flashing material before the application of flashing.

6. Apply a layer of 7 Kg (15 pound) saturated felt followed by a layer of rosin paper to wood surfaces to be covered with copper. Lap each ply 50 mm (2 inch) with the slope and nail with large headed copper nails.
7. Confine direct nailing of sheet metal to strips 300 mm (12 inch) or less wide. Nail flashing along one edge only. Space nail not over 100 mm (4 inches) on center unless specified otherwise.
8. Install bolts, rivets, and screws where indicated, specified, or required in accordance with the SMACNA Sheet Metal Manual. Space rivets at 75 mm (3 inch) on centers in two rows in a staggered position. Use neoprene washers under fastener heads when fastener head is exposed.
9. Coordinate with roofing work for the installation of metal base flashings and other metal items having roof flanges for anchorage and watertight installation.
10. Nail continuous cleats on 75 mm (3 inch) on centers in two rows in a staggered position.
11. Nail individual cleats with two nails and bend end tab over nail heads. Lock other end of cleat into hemmed edge.
12. Install flashings in conjunction with other trades so that flashings are inserted in other materials and joined together to provide a water tight installation.
13. Where required to prevent galvanic action between dissimilar metal isolate the contact areas of dissimilar metal with sheet lead, waterproof building paper, or a coat of bituminous paint.
14. Isolate aluminum in contact with dissimilar metals others than stainless steel, white bronze or other metal compatible with aluminum by:
 - a. Paint dissimilar metal with a prime coat of zinc-chromate or other suitable primer, followed by two coats of aluminum paint.
 - b. Paint dissimilar metal with a coat of bituminous paint.
 - c. Apply an approved caulking material between aluminum and dissimilar metal.
15. Paint aluminum in contact with or built into mortar, concrete, plaster, or other masonry materials with a coat of bituminous paint.
16. Paint aluminum in contact with absorptive materials that may become repeatedly wet with two coats of bituminous paint or two coats of aluminum paint.

17. Bitumen Stops:

- a. Install bitumen stops for built-up roof opening penetrations through deck and at formed sheet metal gravel stops.
- b. Nail leg of bitumen stop at 300 mm (12 inch) intervals to nailing strip at roof edge before roofing material is installed.

3.2 THROUGH-WALL FLASHING

A. General:

1. Install continuous through-wall flashing between top of concrete foundation walls and bottom of masonry building walls; at top of concrete floors; under masonry, concrete, or stone copings and elsewhere as shown.
2. Where exposed portions are used as a counterflashings, lap base flashings at least 100 mm (4 inches) and use thickness of metal as specified for exposed locations.
3. Exposed edge of flashing may be formed as a receiver for two piece counter flashing as specified.
4. Terminate exterior edge beyond face of wall approximately 6 mm (1/4 inch) with drip edge where not part of counter flashing.
5. Turn back edge up 6 mm (1/4 inch) unless noted otherwise where flashing terminates in mortar joint or hollow masonry unit joint.
6. Terminate interior raised edge in masonry backup unit approximately 38 mm (1 1/2 inch) into unit unless shown otherwise.
7. Lap end joints at least two corrugations, but not less than 100 mm (4 inches). Seal laps with sealant.
8. Where dowels, reinforcing bars and fastening devices penetrate flashing, seal penetration with sealing compound. Sealing compound is specified in Section 07 92 00, JOINT SEALANTS.
9. Coordinate with other work to set in a bed of mortar above and below flashing so that total thickness of the two layers of mortar and flashing are same as regular mortar joint.
10. Where ends of flashing terminate turn ends up 25 mm (1 inch) and fold corners to form dam extending to wall face in vertical mortar or veneer joint.
11. Turn flashing up not less than 200 mm (8 inch) between masonry or behind exterior veneer.

12. When flashing terminates in reglet extend flashing full depth into reglet and secure with lead or plastic wedges spaced 150 mm (6 inch) on center.
13. Continue flashing around columns:
 - a. Where flashing cannot be inserted in column reglet hold flashing vertical leg against column.
- B. Flashing at Top of Concrete Foundation Walls Where concrete is exposed. Turn up not less than 200 mm (8 inch) high and into masonry backup mortar joint or reglet in concrete backup as specified.
- C. Flashing at Top of Concrete Floors (except where shelf angles occur): Place flashing in horizontal masonry joint not less than 200 mm (8 inch) below floor slab and extend into backup masonry joint at floor slab 38 mm (1 1/2 inch).
- D. Flashing at Veneer Walls:
 1. Install near line of finish floors over shelf angles or where shown.
 2. Turn up against sheathing.
 3. At stud framing, hem top edge 19 mm (3/4 inch) and secure to each stud with stainless steel fasteners through sheathing.
 4. Coordinate with installation of waterproofing or asphalt felt for lap over top of flashing.
- E. Lintel Flashing when not part of shelf angle flashing:
 1. Install flashing full length of lintel to nearest vertical joint in masonry over veneer.
 2. Turn ends up 25 mm (one inch) and fold corners to form dam and extend end to face of wall.
 3. Turn back edge up to top of lintel; terminate back edge as specified for back-up wall.
- F. Window Sill Flashing:
 1. Install flashing to extend not less than 100 mm (4 inch) beyond ends of sill into vertical joint of masonry or veneer.
 2. Turn back edge up to terminate under window frame.
 3. Turn ends up 25 mm (one inch) and fold corners to form dam and extend to face of wall.
- G. Door Sill Flashing:
 1. Install flashing under bottom of plate sills of doors over curbs opening onto roofs. Extend flashing out to form counter flashing or receiver for counter flashing over base flashing. Set in sealant.

2. Extend sill flashing 200 mm (8 inch) beyond jamb opening. Turn ends up one inch in vertical masonry joint, extend end to face of wall. Join to counter flashing for water tight joint.
3. Where doors thresholds cover over waterproof membranes install sill flashing over water proof membrane under thresholds. Extend beyond opening to cover exposed portion of waterproof membrane and not less than 150 mm (6 inch) beyond door jamb opening at ends. Turn up approximately 6 mm (1/4 inch) under threshold.

H. Flashing at Masonry, Stone, or Precast Concrete Copings:

1. Install flashing with drips on both wall faces unless shown otherwise.
2. Form penetration openings to fit tight against dowel or other item with edge turned up. Seal penetrations with sealant.

3.3 COUNTERFLASHING (CAP FLASHING OR HOODS)

A. General:

1. Install counterflashing over and in conjunction with installation of base flashings, except as otherwise specified or shown.
2. Install counterflashing to lap base flashings not less than 100 mm (4 inch).
3. Install upper edge or top of counterflashing not less than 225 mm (9 inch) above top of the roofing.
4. Lap joints not less than 100 mm (4 inch). Stagger joints with relation to metal base flashing joints.
5. When fastening to concrete or masonry, use screws driven in expansion shields set in concrete or masonry. Use screws to wood and sheet metal. Set fasteners in mortar joints of masonry work.

B. Two-Piece Counterflashing:

1. Where receiver is installed at new masonry coordinate to insure proper height, embed in mortar, and lap.
2. Insert counter flashing in receiver in accordance with fabricator or manufacturer's instructions and to fit tight against base flashing.

C. When counter flashing is a component of other flashing install as shown.

3.4 REGLETS

- A. Install reglets in a manner to provide a watertight installation.

- B. Locate reglets not less than 225 mm (9 inch) nor more than 400 mm (16 inch) above roofing, and not less than 125 mm (5 inch) nor more than 325 mm (13 inch) above cant strip.
- C. Butt and align end joints on each section of reglet and securely hold in position until concrete or mortar are hardened:
 - 1. Coordinate reglets for masonry to locate horizontally into mortar joints.

3.5 FASCIAS

- A. General:
 - 1. Install fascias with allowance for expansion at each joint; minimum of 6 mm (1/4 inch).
 - 2. Install continuous cleat for fascia drip edge. Secure with fasteners as close to lower edge as possible on 75 mm (3 inch) centers.
 - 3. Where ends of fascias abut a vertical wall, provide a watertight, flashed and sealant filled joint.
 - 4. Edge securement for low-slope roofs: Low-slope membrane roof systems metal edge securement, except gutters, shall be designed in accordance with ANSI/SPRI ES-1, except the basic wind speed shall be determined from Figure 1609, of IBC 2003.
- B. Sheet metal fascia:
 - 1. Install with end joints of splice plates sheets lapped three inches.
 - 2. Hook the lower edge of fascia into a continuous edge strip.
 - 3. Lock top section to bottom section for two piece fascia.

3.6 COPINGS

- A. General:
 - 1. On walls topped with a wood plank, install a continuous edge strip on the front and rear edge of the plank. Lock the coping to the edge strip with a 19 mm (3/4 inch) loose lock seam.
 - 2. Where shown turn down roof side of coping and extend down over base flashing as specified for counter-flashing. Secure counter-flashing to lock strip in coping at continuous cleat.
 - 3. Install ends adjoining existing construction so as to form space for installation of sealants. Sealant is specified in Section 07 92 00, JOINT SEALANTS.
- B. Aluminum Coping:
 - 1. Install with 6 mm (1/4 inch) joint between ends of coping sections.

2. Install joint covers, centered at each joint, and securely lock in place.

3.7 HANGING GUTTERS

- A. Hang gutters with high points equidistant from downspouts. Slope at not less than 1:200 (1/16 inch per foot).
- B. Lap joints, except for expansion joints, at least 25 mm (one inch) in the direction of flow. Rivet and seal lapped joints.
- C. Support gutters in brackets spaced not more than 600 mm (24 inch) on centers, brackets attached to fascia or wood nailer by at least two screws or nails.
 1. For aluminum gutters use aluminum brackets or stainless steel brackets.
- D. Secure brackets to gutters in such a manner as to allow free movement of gutter due to expansion and contraction.
- E. Gutter Expansion Joint:
 1. Locate expansion joints midway between outlet tubes.
 2. Provide at least a 25 mm (one inch) expansion joint space between end baffles of gutters.
 3. Install a cover plate over the space at expansion joint.
 4. Fasten cover plates to gutter section on one side of expansion joint only.
 5. Secure loose end of cover plate to gutter section on other side of expansion joint by a loose-locked slip joint.
- F. Outlet Tubes: Set bracket strainers loosely into gutter outlet tubes.

3.8 CONDUCTORS (DOWNSPOUTS)

- A. Where scuppers discharge into downspouts install conductor head to receive discharge with back edge up behind drip edge of scupper. Fasten and seal joint. Sleeve conductors to gutter outlet tubes and fasten joint and joints between sections.
- B. Set conductors plumb and clear of wall, and anchor to wall with two anchor straps, located near top and bottom of each section of conductor. Strap at top shall be fixed to downspout, intermediate straps and strap at bottom shall be slotted to allow not less than 13 mm (1/2 inch) movement for each 3000 mm (10 feet) of downspout.
- C. Install elbows, offsets and shoes where shown and required. Slope not less than 45 degrees.

- - - E N D - - -

THIS PAGE INTENTIONALLY LEFT BLANK

SECTION 07 71 20
ALUMINUM CORNICE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. The provisions included under Division 1, General Requirements, are included as part of this section as though bound herein.

1.2 SUMMARY

- A. Provide labor, material, and equipment necessary for furnishing a complete installation of pre-designed aluminum cornice & decorative trims.
- B. Related Work Specified Elsewhere
 - 1. Division 5 Sections for support framing.
 - 2. Division 6 Sections for nailers and support framing.
 - 3. Division 7 Sections for related roofing

materials. **1.3 SUBMITTALS**

- A. Product Data: Each type of product specified. Submit manufacturer's detailed product data showing dimensions of individual components, profiles, and finishes.
- B. Shop Drawings: Show fabrication and installation of pre-designed cornice including fully dimensioned roof plans, reflective plan views, dimensioned framing requirements, sections and details of components and other related trims.
- C. Finish & Color Selection: Furnish manufacturer's technical data for specified finish and color chart showing full range of colors available.

1.4 QUALITY ASSURANCE

- A. Where pre-engineered manufactured products are specified, other field fabricated or shop/field fabricated substitutions will not be accepted. However, where shop/field fabrications are indicated pre-engineered systems will be considered with Architect approval.
- B. Obtain all components and related accessories from one single source manufacturer.
- C. Follow manufacturer's guidelines & shop drawings for installing pre-designed cornice & decorative trims. If cornice or trims join a roof system then follow primary roofing manufacturer's printed instructions for installing associated roof material for flashing decorative trims to roof.

1.5 DELIVERY, STORAGE & HANDLING

- A. All products delivered shall be stored in a clean dry location prior to installation.
- B. Products furnished with strippable protective masking shall not be exposed to direct sunlight for more than 30 minutes without removing masking.
- C. Do not install finished materials with scars or abrasions.

1.6 PROJECT CONDITIONS

- A. Coordinate work of this Section with adjoining work for proper sequencing to ensure protection from inclement weather and to protect materials and their finish against damage.
- B. Do not install cornice & decorative trims during inclement weather. When installing in cold climates warm sealant to at least 50 degrees Fahrenheit prior to application.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Basis-of-Design pre-design aluminum cornice, decorative trims, and accessories as manufactured by Perimeter Systems, a division of Southern Aluminum Finishing Company, Inc.
143 Charlotte Ave., Suite 104
Sanford, North Carolina 27330
1-800-334-9823, or approved equal

2.2 TYPE

- A. Basis-of-Design: Provide Perimeter Systems' Designer Series Cornice System "Cornice Design Number #4 as indicated on plans, or approved equal.

2.3 MATERIALS & FABRICATION

- A. Decorative cornice profiles shall be manufactured from 0.040" mill finished aluminum, 10'-0" lengths, in shapes as indicated by manufacturer's printed literature and as indicated on plans.
 - 1. All profiles containing radius bends shall be press formed with radius dies on a CNC Press to provide repeated true and accurate profiles.
 - 2. All cornice trims shall be factory punched with elongated fastening holes.
 - 3. All exposed surfaces of cornice profiles shall be finished as specified in this section.

- B. Decorative cornice splices shall be manufactured from 0.040" aluminum, 6" lengths, formed to fit the inside of the cornice profiles.
- C. Support Brackets, attachments brackets and retainer brackets shall be manufactured from 0.125" x 1.00" extruded aluminum bar, hellicarc welded construction (where necessary), factory punched for fasteners.

2.4 ACCESSORIES

- A. Mitered Corners, provide factory mitered corners for all cornice profiles (excluding soffits). Cornice profiles shall be precision saw cut, hellicarc tack welded to produce a picture frame joint.
- B. Sculptured End Caps, provide factory mitered end caps for cornice. Cornice profiles shall be precision saw cut, hellicarc tack welded to produce a picture frame joint.
- C. Cornice Returns, if shown on drawings, provide cornice returns at eaves & rake terminations in lengths as indicated on plans.
- D. Rake & Gable Trims, as shown on drawings, provide rake and gable trims in profiles as indicated complete with concealed splices, attachment brackets (if required).
 - 1. Provide factory mitered corners, precision saw cut, hellicarc tack welded to produce a picture frame joint.

2.5 FINISHES

- A. General: Apply coatings to exposed aluminum components after fabrication for maximum coating performance and to prevent crazing, abrasion, and damage to finished surfaces.
- B. Pretreatment: Aluminum components shall be pretreated with solutions to remove organic and inorganic surface soils, remove residual oxides, followed by a chrome phosphate conversion coating to which organic coatings will firmly adhere.
- C. Coating Type: High Performance Coating, two-coat, shop applied, 70% Polyvinylidene Fluoride (PVDF) coating based on Elf Atochem, Inc. Kynar 500 or Ausimont U.S.A., Inc. Hylar 5000 resin, meeting AAMA 2605 specification.
- D. Color: Select from manufacturer's full range of Colors.

PART 3 EXECUTION

3.1 EXAMINATION

- A. The installer must examine substrates and conditions under which cornice & decorative profiles will be installed. All wood plates and/or fascia boards shall be installed true, straight, and free of splits, cracks, or other irregularities. Do not proceed with installation until unsatisfactory conditions are corrected.
- B. The installer must field verify that framing has been built in accordance with the dimensions furnished by the cornice manufacturer either by shop drawings or published literature. Do not proceed with installation until unsatisfactory conditions are corrected.

3.2 INSTALLATION

- A. General: The pre-designed cornice and decorative trims shall be installed in strict accordance with manufacturer's printed instructions and shop drawings.
- B. Fastening: Cornice trims shall be nailed through elongated holes with 1-1/2" stainless steel nails. Support brackets, retaining brackets and attachment brackets shall be installed with #10 x 2" stainless steel wood screws at locations and spacing as shown on shop drawings.
- C. Install cornice profiles and decorative trims with concealed splice plates over brackets and/or framing substrates as shown on shop drawings. In accordance with shop drawings;
 - 1. Coordinate and align spacing of expansion reveal joints with associated trims (stack joints).
 - 2. Plan spacing of joints so there is no sections of fascia shorter than 48" in length.
 - 3. Check horizontal alignment of fascia during installation and adjust as required.

- - - E N D - - -

**SECTION 07 81 00
APPLIED FIREPROOFING**

PART 1 - GENERAL

1.1 DESCRIPTION

This section specifies mineral fiber and cementitious coverings to provide fire resistance to interior structural steel members shown.

1.2 SUBMITTALS

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Manufacturer's Literature and Data:
 - 1. Manufacturer's complete and detailed application instructions and specifications.
 - 2. Manufacturer's repair and patching instructions.
- C. Certificates:
 - 1. Certificate from testing laboratory attesting fireproofing material and application method meet the specified fire ratings.
 - a. List thickness and density of material required to meet fire ratings.
 - b. Accompanied by complete test report and test record.
 - 2. Manufacturer's certificate indicating sprayed-on fireproofing material supplied under the Contract is same within manufacturing tolerance as fireproofing material tested.
- D. Miscellaneous:
 - 1. Manufacturer's written approval of surfaces to receive sprayed-on fireproofing.
 - 2. Manufacturer's written approval of completed installation.
 - 3. Manufacturer's written approval of the applicators of fireproofing material.

1.3 PRODUCT DELIVERY, STORAGE AND HANDLING

- A. Deliver to job-site in sealed containers marked and labeled to show manufacturer's name and brand and certification of compliance with the specified requirements.
- B. Remove damaged containers from the site.
- C. Store the materials off the ground, under cover, away from damp surfaces.
- D. Keep dry until ready for use.
- E. Remove materials that have been exposed to water before installation from the site.

1.4 QUALITY CONTROL

- A. Test for fire endurance in accordance with ASTM E119, for fire rating specified, in a nationally recognized laboratory.
- B. Manufacturer's inspection and approval of surfaces to receive fireproofing as specified under paragraph Examination.
- C. Manufacturer's approval of fireproofing applications.
- D. Manufacturer's approval of completed installation.
- E. Manufacturer's representative shall observe and advise at the commencement of application, and shall visit the site as required thereafter for the purpose of ascertaining proper application.
- F. Pre-Application Test Area.
 - 1. Apply a test area consisting of a typical overhead fireproofing installation, including not less than 4.5 m (15 feet) of beam and deck.
 - a. Apply to one column.
 - b. Apply for the hourly ratings used.
 - 2. Install in location selected by the Resident Engineer, for approval by the representative of the fireproofing material manufacturer and by the Government.
 - 3. Perform Bond test on painted steel in accordance with ASTM E736.
 - 4. Do not proceed in other areas until installation of test area has been completed and approved.
 - 5. Keep approved installation area open for observation as criteria for sprayed-on fireproofing.

1.5 APPLICABLE PUBLICATIONS

- A. Publications listed below form a part of this specification to the extent referenced. Publications are referenced in the text by the basic designation only.
- B. American Society for Testing and Materials (ASTM):
 - C841-03 Installation of Interior Lathing and Furring
 - C847-06Metal Lath
 - E84-08Surface Burning Characteristics of Building
Materials
 - E119-08 Fire Tests of Building Construction and
Materials
 - E605-93 (R2006) Thickness and Density of Sprayed Fire-Resistive
Materials Applied to Structural Members

- E736-00 Cohesion/Adhesion of Sprayed Fire-Resistive
Materials Applied to Structural Members
- E759-92 (R2005) The Effect of Deflection on Sprayed Fire-
Resistive Material Applied to Structural
Members
- E760-92 (R2005) Impact on Bonding of Sprayed Fire-Resistive
Material Applied to Structural Members
- E761-92 (R2005) Compressive Strength of Fire-Resistive Material
Applied to Structural Members
- E859-93 (R2006) Air Erosion of Sprayed Fire-Resistive Materials
Applied to Structural Members
- E937-93 (R2005) Corrosion of Steel by Sprayed Fire-Resistive
Material Applied to Structural Members
- E1042-02 Acoustically, Absorptive Materials Applied by
Trowel or Spray.
- G21-96 (R2002) Determining Resistance of Synthetic Polymeric
Materials to Fungi

C. Underwriters Laboratories, Inc. (UL):

Fire Resistance Directory...Latest Edition including Supplements

D. Warnock Hersey (WH):

Certification Listings .Latest Edition

E. Factory Mutual System (FM):

Approval GuideLatest Edition including Supplements

PART 2 - PRODUCTS

2.1 SPRAYED-ON FIREPROOFING

A. ASTM E1042, Class (a), Category A.

1. Type I, factory mixed cementitious materials with approved aggregate.
2. Type II, factory mixed mineral fiber with integral inorganic binders minimum 240 kg/m³ (15 lb/ft³) density per ASTM E605 test unless specified otherwise. Use in areas that are completely encased.

B. Materials containing asbestos are not permitted.

- C. Fireproofing characteristics when applied in the thickness and density required to achieve the fire-rating specified.

	Characteristic	Test	Results
1.	Deflection	ASTM E759	No cracking, spalling, or delamination when backing to which it is applied has a deflection up to 1/120 in 3m (10 ft.)
2.	Corrosion-Resistance	ASTM E937	No promotion of corrosion of steel.
3.	Bond Impact	ASTM E760	No cracking, spalling, or delamination.
4.	Cohesion/Adhesion (Bond Strength)	ASTM E736	Minimum cohesive/adhesive strength of 9.57 kPa (200 lbf/ft ²) for protected areas. 19.15 kPa (400 lbf/ft ²) for exposed areas.
5.	Air Erosion	ASTM E859	Maximum gain weight of the collecting filter 0.27gm/m ² (0.025 gm/ft ²).
6.	Compressive Strength	ASTM E761	Minimum compressive strength 36 kPa (5 lbf/in ²).
7.	Surface Burning Characteristics with adhesive and sealer to be used	ASTM E84	Flame spread 25 or less smoke developed 50 or less
8.	Fungi Resistance	ASTM G21	Resistance to mold growth when inoculated with aspergillus niger (28 days for general application)

2.2 ADHESIVE

- A. Bonding adhesive for Type II (fibrous) materials as recommended and supplied by the fireproofing material manufacturer.
- B. Adhesive may be an integral part of the material or applied separately to surface receiving fireproofing material.

2.3 SEALER

- A. Sealer for Type II (fibrous) material as recommended and supplied by the fireproofing material manufacturer.
- B. Surface burning characteristics as specified for fireproofing material.
- C. Fungus resistant.
- D. Sealer may be an integral part of the material or applied separately to the exposed surface. When applied separately use contrasting color pigmented sealer, white preferred.

2.4 WATER

- A. Clean, fresh, and free from organic and mineral impurities.
- B. pH of 6.9 to 7.1. 2.5

MECHANICAL BOND MATERIAL

- A. Expanded Metal Lath: ASTM C847, minimum weight of 0.92 kg/m² (1.7 pounds per square yard).
- B. Fasteners: ASTM C841.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify surfaces to receive fireproofing are clean and free of dust, soot, oil, grease, water soluble materials or any foreign substance which would prevent adhesion of the fireproofing material.
- B. Verify hangers, inserts and clips are installed before the application of fireproofing material.
- C. Verify ductwork, piping, and other obstructing material and equipment is not installed that will interfere with fireproofing installation.
- D. Verify concrete work on steel decking and concrete encased steel is completed.
- E. Verify temperature and enclosure conditions are required by fireproofing material manufacturer.

3.2 APPLICATION

- A. Do not start application until written approval has been obtained from manufacturer of fireproofing materials that surfaces have been inspected by the manufacturer or his representative, and are suitable to receive sprayed-on fireproofing.
- B. Coordinate application of fireproofing material with other trades.
- C. Application of Metal Lath:
 - 1. Apply to beam and columns having painted surfaces which fail ASTM E736 Bond Test requirements in pre-application test area.
 - 2. Apply to beam flanges 300 mm (12-inches) or more in width.
 - 3. Apply to column flanges 400 mm (16-inches) or more in width.
 - 4. Apply to beam or column web 400 mm (16-inches) or more in depth.
 - 5. Tack weld or mechanically fasten on maximum of 300 mm (12-inch) center.
 - 6. See design criteria section of the approved assemblies used.
 - 7. Lap and tie lath member in accordance with ASTM C841.
- D. Mix and apply in accordance with manufacturer's instructions.
 - 1. Mechanically control material and water ratios.

2. Apply adhesive and sealer, when not an integral part of the materials, in accordance with the manufacturer's instructions.
 3. Apply to density and thickness indicated in UL Fire Resistance Directory, FM Approval Guide, or WH Certification Listings unless specified otherwise. Test in accordance with ASTM E119.
 4. Minimum applied dry density per cubic meter (cubic foot) for the underside of the walk on deck (interstitial) hung purl in or beam and steel deck, columns in interstitial spaces and mechanical equipment rooms shall be as follows:
 - a. Type I - 240 kg/m³ (15 lb/ft³).
 - b. Type II - 350 kg/m³ (22 lb/ft³).
- E. Application shall be completed in one area, inspected and approved by Resident Engineer before removal of application equipment and proceeding with further work.

3.3 FIELD TESTS

- A. Tests of applied material will be performed by VA retained Testing Laboratory. See Section 01 45 29, TESTING LABORATORY SERVICES.
- B. Resident Engineer will select area to be tested in specific bays on each floor using a geometric grid pattern.
- C. Test for thickness and density in accordance with ASTM E605. Areas showing thickness less than that required as a result of fire endurance test will be rejected.
- D. Areas showing less than required fireproofing characteristics will be rejected on the following field tests.
 1. Test for cohesion/adhesion: ASTM E736.
 2. Test for bond impact strength: ASTM

E760. 3.3 PATCHING AND REPAIRING

- A. Inspect after mechanical, electrical and other trades have completed work in contact with fireproofing material, but before sprayed material is covered by subsequent construction.
- B. Perform corrective measures in accordance with fireproofing material Manufacturer's recommendations.
 1. Respray areas requiring additional fireproofing material to provide the required thickness, and replace dislodged or removed material.
 2. Spray material for patching by machine directly on point to be patched, or into a container and then hand apply.
 3. Hand mixing of material is not permitted.

C. Repair:

1. Respray all test and rejected areas.
2. Patch fireproofing material which is removed or disturbed after approval.

D. Perform final inspection of sprayed areas after patching and repair.

3.5 SCHEDULE

A. Apply fireproofing material in interior structural steel members and on underside of interior steel floor and roof decks, except on following surfaces:

1. Structural steel and underside of steel decks in elevator or dumbwaiter machine rooms.
2. Steel members in elevator hoist ways.
3. Areas used as air handling plenums.
4. Steel to be encased in concrete or designated to receive other type of fireproofing.

B. Type I:

1. One hour fire rating.
2. Two hour fire rating.
3. Three hour fire rating.

C. Type II:

1. One hour fire rating.
2. Two hour fire rating.

- - - E N D - - -

THIS PAGE INTENTIONALLY LEFT BLANK

SECTION 07 81 23
INTUMESCENT MASTIC FIREPROOFING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes mastic and intumescent fire-resistive coatings (MIFRC).
- B. Related Requirements:
 - 1. Section 078100 "Applied Fireproofing" for sprayed fire-resistive materials (SFRM).

1.2 SUBMITTALS

- A. Product certificates.
- B. Evaluation reports.
- C. Field quality-control reports.

1.3 QUALITY ASSURANCE

- A. Installer Qualifications: A firm or individual certified, licensed, or otherwise qualified by fireproofing manufacturer as experienced and with sufficient trained staff to install manufacturer's products according to specified requirements.

PART 2 - PRODUCTS

2.1 MATERIALS, GENERAL

- A. Assemblies: Provide fireproofing, including auxiliary materials, according to requirements of each fire-resistance design and manufacturer's written instructions.
- B. Fire-Resistance Design: Indicated on Drawings, tested according to ASTM E 119 or UL 263 by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

2.2 MASTIC AND INTUMESCENT FIRE-RESISTIVE COATINGS

- A. MIFRC <Insert drawing designation>: Manufacturer's standard, factory-mixed, multi-component system consisting of intumescent base coat and topcoat, and complying with indicated fire-resistance design.
 - 1. Products: Subject to compliance with requirements, Basis-of-Design is Isolatek International™. CAFCO SprayFilm -WB 5.
 - 2. Application: Designated for "exterior" use by a qualified testing agency acceptable to authorities having jurisdiction.
 - 3. Thickness: As required for fire-resistance design indicated, measured according to requirements of fire-resistance design.

4. Surface-Burning Characteristics: Flame-spread and smoke-developed indexes of 5 and 30, respectively, or less according to ASTM E 84.
5. Finish: As selected by Architect from manufacturer's standard finishes and skip troweled finish.
 - a. Color and Gloss: Match Architect's sample.

2.3 AUXILIARY MATERIALS

- A. General: Provide auxiliary materials that are compatible with fireproofing and substrates and are approved by UL or another testing and inspecting agency acceptable to authorities having jurisdiction for use in fire-resistance designs indicated.
- B. Substrate Primers: Primers approved by fireproofing manufacturer.
- C. Topcoat: Suitable for application over applied fireproofing; of type recommended in writing by fireproofing manufacturer for each fire-resistance design.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Cover other work subject to damage from fallout or overspray of fireproofing materials during application.
- B. Prime substrates where included in fire-resistance design and where recommended in writing by fireproofing manufacturer unless compatible shop primer has been applied and is in satisfactory condition to receive fireproofing.
- C. For applications visible on completion of Project, repair substrates to remove surface imperfections that could affect uniformity of texture and thickness in finished surface of fireproofing.

3.2 APPLICATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for substrates and other conditions affecting performance of the Work and according to each fire-resistance design. Verify that objects penetrating fireproofing are securely attached to substrates and that substrates receiving fireproofing are not obstructed by ducts, piping, equipment, or other suspended construction that will interfere with fireproofing application.

- B. Construct fireproofing assemblies that are identical to fire-resistance design indicated and products as specified, tested, and substantiated by test reports; for thickness, primers, topcoats, finishing, and other materials and procedures affecting fireproofing work.
- C. Spray apply fireproofing to maximum extent possible. Following the spraying operation in each area, complete the coverage by trowel application or other placement method recommended in writing by fireproofing manufacturer.
- D. Do not install enclosing or concealing construction until after fireproofing has been applied, inspected, and tested and corrections have been made to deficient applications.
- E. Finishes: Where indicated, apply fireproofing to produce the following finishes:
 - 1. Manufacturer's Standard Finishes: Finish according to manufacturer's written instructions for each finish selected at concealed surfaces.
 - 2. Skip-Troweled Finish: Even leveled surface produced by troweling spray-applied finish to smooth out the texture and neaten edges at exposed surfaces.

3.3 FIELD QUALITY CONTROL

- A. Special Inspections: Engage a qualified special inspector to perform the following special inspections:
 - 1. Test and inspect as required by the IBC, 1704.11.
- B. Fireproofing will be considered defective if it does not pass tests and inspections.
 - 1. Remove and replace fireproofing that does not pass tests and inspections, and retest.
 - 2. Apply additional fireproofing, per manufacturer's written instructions, where test results indicate insufficient thickness, and retest.
- C. Prepare test and inspection reports.

3.4 CLEANING AND REPAIRING

- A. Cleaning: Immediately after completing spraying operations in each containable area of Project, remove material overspray and fallout from surfaces of other construction and clean exposed surfaces to remove evidence of soiling.

- B. Repair fireproofing damaged by other work before concealing it with other construction.
- C. Repair fireproofing by reapplying it using same method as original installation or using manufacturer's recommended trowel-applied product.

- - - E N D - - -

SECTION 07 84 00

FIRESTOPPING PENETRATIONS, JOINTS AND PERIMETER FIRE CONTAINMENT

PART 1 GENERAL

1.0 RELATED DOCUMENTS

- A. BIDDING REQUIREMENTS, CONTRACTING REQUIREMENTS, and applicable parts of DIVISION 1 - GENERAL REQUIREMENTS.

1.1 DESCRIPTION SUMMARY

- A. Provide firestop systems consisting of a material, or combination of materials installed to retain the integrity of fire-rated construction by maintaining an effective barrier against the spread of flame, smoke, and/or hot gases through penetrations, blank openings, construction joints, or at perimeter fire containment in or adjacent to fire-rated barriers in accordance with the requirements of the Building Code for this project.
- B. Firestop systems shall be used in locations including, but not limited to, the following:
 - 1. Penetrations through fire-resistance-rated floor and roof assemblies requiring protected openings including both empty openings and openings that contain ducts, pipes, wires, conduits, etc.
 - 2. Penetrations through fire-resistance-rated wall assemblies including both empty openings and openings that contain ducts, pipes, wires, conduits, etc.
 - 3. Membrane penetrations in fire-resistance-rated wall assemblies where items penetrate one side of the barrier.
 - 4. Joints in fire-resistance-rated assemblies to allow independent movement.
 - 5. Perimeter Fire Barrier System between a rated floor/roof and an exterior wall assembly.
- C. Firestop contractor shall provide Documentation of non-conforming penetrations or systems, repairs made to existing conditions, new construction, and detailed barrier report. Report shall include the following unless otherwise provided in the solicitation.
 - 1. Label each installed system with numbered label, the name of the installer, system installed, materials used, and date installed.
 - 2. Label substrate (fire and smoke walls only, not floor separations) to identify rated designation i.e. 1 hour, 2 hour etc.

1.2 RELATED WORK

A. Examine Contract Documents for requirements that affect Work of this Section. Other Specification Sections that relate directly to Work of this Section include, but are not limited to:

1. Division 3 - CAST-IN-PLACE CONCRETE; Concrete work
2. Division 4 - UNIT MASONRY
3. Division 7 - THERMAL AND MOISTURE PROTECTION
4. Division 8 - GLAZING
5. Division 9 - GYPSUM WALLBOARD
6. Division 15 - MECHANICAL
7. Division 16 - ELECTRICAL, LIGHTING, POWER, ALARMS, and COMMUNICATIONS

1.3 REFERENCES

A. Comply with applicable requirements of the following standards. Where these standards conflict with other specified requirements, the most restrictive requirement shall govern.

1. American Society for Testing and Materials (ASTM).
 - a) E 84 Test Method for Surface Burning Characteristics of Building Materials
 - b) E 119 Test Method for Fire Tests of Building Construction and Materials
 - c) E 136 Test Method for Behavior of Materials in a Vertical Tube Furnace at 750F
 - d) E 814 Fire Tests of Through-Penetration Fire Stops
 - e) E 1399 Cyclic Movement and Measuring Minimum and Maximum Joint Widths
 - f) E 1966 Test Method for Resistance of Building Joint
 - g) E 2174 Standard Practice for On-Site Inspection of Installed Fire Stops
 - h) E 2393 Standard Practice for On-Site Inspection of Installed Fire Stop Joint Systems
 - i) E 2307 Standard Test Method for Determining the Fire Endurance of Perimeter Fire Barrier Systems Using the Intermediate-Scale, Multi Story Test Apparatus (ISMA)
2. Firestop Contractors International Association (FCIA):
 - a) M.O.P. Manual of Practice
3. International Firestop Council (IFC):
 - a) Ref. 1 Recommended IFC Guidelines for Evaluating Firestop Engineering Judgments (April 2001)

b) Ref. 2 Inspectors Field Pocket Guide

4. National Fire Protection Association (NFPA):
 - a) NFPA 70 - National Electric Code
 - b) NFPA 101 - Life Safety Code
 - c) NFPA 221 - Fire Walls and Fire Barriers (preliminary to be released)
 - d) NFPA 251 - Fire Tests of Building Construction and Materials
5. Underwriters Laboratories, Inc. (UL):
 - a) UL 263 Fire Tests of Building Construction and Materials
 - b) UL 723 Surface Burning Characteristics of Building Materials
 - c) UL 1479 Fire-Tests of Through-Penetration Fire Stops
 - d) UL 2079 Tests for Fire Resistance of Building Joint Systems

1.4 SYSTEM PERFORMANCE REQUIREMENTS

- A. Penetrations: Provide and install firestopping systems that are produced to resist the spread of fire, and the passage of smoke and other gases according to requirements indicated, including but not limited to the following:
 1. Firestop all penetrations passing through fire resistance rated wall and floor assemblies and other locations as indicated on the drawings.
 2. Provide and install complete penetration firestopping systems that have been tested and approved by third party testing agency.
 3. F - Rated Through-Penetration Firestop Systems: Provide through-penetration firestop systems with F ratings indicated, as determined per ASTM E 814, but not less than one hour or the fire-resistance rating of the construction being penetrated.
 4. T - Rated Through-Penetration Firestop Systems: Provide firestop systems with T ratings, in addition to F ratings, as determined per ASTM E 814, where indicated by Code.
 5. L - Rated Through-Penetration Firestop Systems: Provide firestop systems with L ratings, in addition to F and T ratings, as determined per UL 1479, where indicated by Code.
 6. W - Rated Through-Penetration Firestop Systems: Provide firestop systems with W Water Resistance ratings, in addition to F, T, and L ratings, as determined per UL 1479, where indicated.
- B. Perimeter Fire Containment Systems: Provide interior perimeter joint systems with fire-resistance ratings indicated, as determined per ASTM E 2307, but not less than the fire-resistance rating of the floor construction.

- C. Fire-Resistive Joints: Provide joint systems with fire-resistance ratings indicated, as determined per UL 2079, but not less than the fire-resistance rating of the construction in which the joint occurs.
- D. For firestopping exposed to view, traffic, moisture, or physical damage, provide appropriate firestop systems for these conditions.
- E. Where there is no specific third party tested and classified firestop system available for a particular firestop configuration, the firestopping contractor shall obtain from the firestop manufacturer, an Engineering Judgment (EJ) or Equivalent Fire Resistance Rated Assembly (EFFRA) for submittal.

1.5 SUBMITTALS

- A. Submit in accordance with Section 01 33 23, shop drawings, product data, and samples.
- B. Submit Manufacturers Product Data Sheets for each type of product selected. Certify that Firestop Material shall be asbestos free and complies with local regulations.
 - 1. Certification by firestopping manufacturer, that products supplied comply with local regulations controlling use of volatile organic compounds (VOC's) and are nontoxic to building occupants.
- C. Submit system design listings, including illustrations from a qualified testing and inspection agency that is applicable to each firestop configuration

1.6 QUALITY ASSURANCE

- A. Fire-Test-Response Characteristics: Provide firestopping System Design Listing by a testing and inspection agency in accordance with the appropriate ASTM Standard(s) per article 1.04. A qualified testing and inspection agency may be UL, FM Research, Intertek Testing Services, Omega Point Laboratories (OPL) ,or another agency performing testing and follow-up inspection services for firestop materials that is acceptable to the authority having jurisdiction.
- B. Contractor Qualifications: Acceptable installer firms shall be:
 - 1. FM Approved in accordance with FM Standard 4991 - Approval of Firestop Contractors
 - 2. Underwriter Laboratories (UL) Qualified Firestop Contractor
 - 3. Licensed by the State or local authority, where applicable.
 - 4. Shown to have successfully completed not less than 5 comparable scale, or larger, projects.
 - 5. Evidence of a Quality Management System or equivalent system based on ISO 9000 principles

- a. Must have approved QMS by UL or approved FM Certification Process
- b. Shall demonstrate latest audit findings if completed prior to award by UL, FM, or Representatives of accrediting, qualifying, or certifying entities (Current is within established timelines set by UL or FM)
- C. Manufacturer Source Requirements: Obtain firestop systems for each kind of penetration and construction condition indicated from a single primary firestop systems manufacturer unless otherwise permitted by the organization.
 - 1. The organization reserves the right to approve and limit the manufactures and types of manufacturer's products. Materials of different manufacture than allowed by the tested and listed system shall not be intermixed in the same firestop system or opening.
 - 2. Tested and listed firestop systems are to be used before an Engineering Judgment (EJ) or Equivalent Fire Resistance Rated Assembly (EFRRRA) is installed.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Deliver firestopping products to project site in original, unopened containers or packages with intact and legible manufacturers' labels identifying product and manufacturer.
- B. Ensure that manufacturers products are not diluted mixed or otherwise altered unless permitted by the manufactures directions.
- C. Store and handle firestopping materials in accordance with manufacturers written instructions. Product and equipment staging and storage must be approved by the COTR.

1.8 PROJECT CONDITIONS

- A. Environmental Conditions: Install firestopping in accordance with manufacturers written instructions.
- B. Ventilation: Ventilate per firestopping manufacturers' instructions or Material Safety Data Sheet (MSDS)

1.9 SEQUENCING AND SCHEDULING

- A. Project coordination is essential to inform and educate all the parties involved with the firestopping process of their role and how they can affect firestopping on the project. A pre-construction meeting shall be scheduled and required for all parties involved prior to the start of construction.

B. Do not cover up firestopping installations until Owner's inspection agency or the Authorities Having Jurisdiction have examined each installation.

- C. When work takes place within existing building that are not separated by a 2-hour barrier from occupied areas, and where it is not feasible to have a qualified firestop contractor providing fire sealing on a daily basis, it shall be the responsibility of the trade penetrating the fire rated barrier to provide temporary fire protection of all penetrations at the end of each work day. Temporary protection must meet all NFPA codes related to fire barrier penetrations. The temporary protection must be maintained in proper order until the permanent fire stopping material is installed.

1.10 ENVIRONMENTAL REGULATIONS

- A. All materials shall be asbestos free and comply with local VOC Regulations.
- B. If required, hazardous disposal of firestop materials shall be strictly observed as noted on the individual MSDS.
- C. Bulk storage shall be preapproved and in locations as to not present a hazard to the environment or risk to occupants.

PART 2 PRODUCTS

2.1 FIRESTOPPING, GENERAL

- A. Systems listed by approved testing agencies, as identified in part 1 above, may be used, providing they conform to the construction type, penetrant type, annular space requirements and fire rating involved in each separate instance.
- B. Manufacturer of firestop products shall have been successfully producing and supplying these products for a period of not less than 3 years, and be able to show evidence of at least 10 projects where similar products have been installed and accepted.
- C. Allowable firestop products produced by FCIA Manufacturer Members in good standing.
 - 1. 3M Fire Protection Products
 - 2. HILTI, Inc.
 - 3. Specified Technologies, Inc.
 - 4. Thermafiber, LLC

PART 3 EXECUTION

3.1 EXAMINATION

- A. Examine substrates and conditions, with installer present, for compliance with requirements for opening configurations, penetrating items, substrates, and other conditions affecting performance of firestopping. Notify the responsible party or parties of any

unsatisfactory conditions. Do not proceed with installation until unsatisfactory conditions have been corrected.

- B. Identifying any unique conditions that may create unusual construction dust, noise, or other impacts to infection control or life safety that may be outside of established and approved methods of the organization.

3.2 PREPARATION

- A. Priming: Prime substrates where recommended by firestopping manufacturer using that manufacturer's recommended products and methods. Confine primers to areas of bond. Do not allow spillage and migration onto exposed surfaces.
- B. Masking Tape: Use masking tape to prevent firestopping from contacting adjoining surfaces that will remain exposed upon completion of work. Remove tape as soon as it is possible to do so without disturbing the firestopping seal with substrates.
- C. Verify that system components are clean, dry, and ready for installation.
- D. Verify that field dimensions are as shown on the drawings and as recommended by the manufacturer.

3.3 INSTALLING PENETRATION FIRESTOPS

- A. General: Comply with the "System Performance Requirements" article in Part 1 and the through-penetration firestop manufacturer's installation instructions and drawings pertaining to products and applications indicated.
 - 1. Coordinate with other trades to assure that all pipes, conduit, cable, and other items, which penetrate fire rated construction, have been permanently installed prior to installation of firestop assemblies.
 - 2. Schedule the work to assure that partitions and all other construction that conceals penetrations are not erected prior to the installation of firestop and smoke seals.
- B. Install forming/damming materials and other accessories in accordance with manufacturers written instructions.
- C. Install fill materials for through-penetration firestop systems by proven techniques to produce the following results:
 - 1. Completely fill voids and cavities formed by openings, forming materials, accessories, and penetrating items.
 - 2. Install materials so they contact and adhere to substrates formed by openings and penetrating items.

3. For fill materials that will remain exposed after completing Work, finish to produce smooth, uniform surfaces.

- D. Install approved fire stopping sealant around items that penetrate between floors. Install sealant around penetrations at both sides of floor level, at floor level of penetration and underside of floor level below.

3.4 INSTALLING FIRESTOP JOINT SYSTEMS

- A. General: Comply with the "System Performance Requirements" article in Part 1 and with the firestop manufacturer's installation instructions and drawings pertaining to products and applications indicated.
 - 1. Install joint fillers to provide support of firestop materials during application and at the position required to produce the cross-sectional shapes and depths of installed firestop material relative to joint widths that allow optimum sealant movement capability and develop fire-resistance rating required.
- B. Install systems by proven techniques that result in a sound firestop system:
 - 1. Directly contacting and fully wetting joint substrates.
 - 2. Completely filling recesses provided for each joint configuration,
 - 3. Providing uniform, cross-sectional shapes and depths relative to joint width that optimize movement capability.
- A. Tool non-sag firestop materials immediately after their application and prior to the time skinning begins. Form smooth, uniform beads of configuration indicated or required to:
 - 1. Produce fire-resistance rating
 - 2. To eliminate air pockets
 - 3. To ensure contact and adhesion with sides of

joint. 3.5 INSTALLING PERIMETER FIRE BARRIER SYSTEMS

- A. General: Comply with "System Performance Requirements" article in Part 1 and with the firestop manufacture's installation and drawings pertaining to products and applications indicated.
- B. Install metal framing, curtain wall insulation, mechanical attachments, and firestop materials as applicable within the system design.

3.6 FIELD QUALITY CONTROL

- A. Inspection - The VA organization may require an independent inspection agency employed and paid by the VA to examine penetration firestopping in accordance with ASTM E - 2174, "Standard Practice for On-Site Inspection of Installed Fire Stops and ASTM E-2393, "Standard Practice for On-Site Inspection of Installed Fire Stop Joint Systems. Inspection agency will examine firestopping and will determine, in

general, that

07 84 00 - 12 firestopping has been installed

in compliance with requirements of tested and listed firestop system, and installation process conforms to FM 4991 - Standard for Approval of Firestop Contractors or UL Qualified Firestop Contractor Program.

- B. The inspector shall advise the contractor of any deficiencies noted within one (1) working day.
- C. Do not proceed to enclose firestopping with other construction until inspection agency has verified that the firestop installation complies with the requirements.
- D. Where deficiencies are found, repair or replace the firestopping so that it complies with requirements of tested and listed system design.

3.7 CLEAN-UP AND SPECIAL WORKING CONDITIONS

- A. Firestop Material: Clean off excess fill materials and sealants adjacent to openings and joints as work progresses. Use methods and cleaning materials approved by manufacturers of firestopping products and or assemblies in which openings and joints occur.
- B. Protect firestopping during and after curing period from contact with contaminating substances. If damage caused by others, owner and general contractor to instruct firestop contractor to make appropriate repairs and charge to appropriate trades.
- C. Debris: Removal of litter and debris shall be in closed or covered containers at the end of each shift or more often as necessary to prevent unsafe fire conditions and reduce construction dusts. The organization may require additional measures in areas where compromised patients are housed or treated.
 - 1. Areas may include special procedure areas, operating rooms, special ventilation rooms, and other spaces deemed critical.
 - 2. Such areas may require specialized local barriers to be erected prior to commencing work. Special consideration to scheduling and potentially working in off tour hours may be necessary.
- D. Surfaces: Ceiling grids shall be replaced at the end of each shift unless prior approval by the Contracting Officer Technical Representative. Floors and other surfaces that may become contaminated by construction dust and debris as a result of the work shall be cleaned following completion of each repair location in a manner acceptable to the organization.
- E. Mitigation Measures: Where work may temporary eliminate or restrict life safety features as determined by the organization. Special

Interim Life Safety Measures (ILSMs) may be required as mitigating measures.

3.8 WARRANTY

- A. Firestopping work subject to the terms of the Article "Warranty of Construction", FAR clause 52.246-21, except extend the warranty period to five years.

- - - E N D - - -

**SECTION 07 92 00
JOINT SEALANTS**

PART 1 - GENERAL

1.1 DESCRIPTION:

Section covers all sealant and caulking materials and their application, wherever required for complete installation of building materials or systems.

1.2 RELATED WORK:

- A. Sealing of site work concrete paving: Section 32 05 23, CEMENT AND CONCRETE FOR EXTERIOR IMPROVEMENTS.
- B. Masonry control and expansion joint: Section 04 20 00, UNIT MASONRY.
- C. Firestopping penetrations: Section 07 84 00, FIRESTOPPING.
- D. Glazing: Section 08 80 00, GLAZING.
- E. Mechanical Work: Section 21 05 11, COMMON WORK RESULTS FOR FIRE SUPPRESSION, Section 22 05 11, COMMON WORK RESULTS FOR PLUMBING, Section 23 05 11, COMMON WORK RESULTS FOR HVAC.

1.3 QUALITY CONTROL:

- A. Installer Qualifications: An experienced installer who has specialized in installing joint sealants similar in material, design, and extent to those indicated for this Project and whose work has resulted in joint-sealant installations with a record of successful in-service performance.
- B. Source Limitations: Obtain each type of joint sealant through one source from a single manufacturer.
- C. Product Testing: Obtain test results from a qualified testing agency based on testing current sealant formulations within a 12-month period.
 - 1. Testing Agency Qualifications: An independent testing agency qualified according to ASTM C1021.
 - 2. Test elastomeric joint sealants for compliance with requirements specified by reference to ASTM C920, and where applicable, to other standard test methods.
 - 3. Test other joint sealants for compliance with requirements indicated by referencing standard specifications and test methods.
- D. Preconstruction Field-Adhesion Testing: Before installing elastomeric sealants, field test their adhesion to joint substrates in accordance with sealant manufacturer's recommendations:
 - 1. Locate test joints where indicated or, if not indicated, as directed by Contracting Officer.

2. Conduct field tests for each application indicated below:
 - a. Each type of elastomeric sealant and joint substrate indicated.
 - b. Each type of non-elastomeric sealant and joint substrate indicated.
 3. Notify COTR seven days in advance of dates and times when test joints will be erected.
- E. VOC: Acrylic latex and Silicon sealants shall have less than 50g/l VOC content.
- F. Mockups: Before installing joint sealants, apply elastomeric sealants as follows to verify selections made under sample Submittals and to demonstrate aesthetic effects and qualities of materials and execution:
1. Joints in mockups of assemblies specified in other Sections that are indicated to receive elastomeric joint sealants, which are specified by reference to this section.

1.4 SUBMITTALS:

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Manufacturer's installation instructions for each product used.
- C. Manufacturer's Literature and Data:
 1. Caulking compound
 2. Primers
 3. Sealing compound, each type, including compatibility when different sealants are in contact with each other.

1.5 PROJECT CONDITIONS:

- A. Environmental Limitations:
 1. Do not proceed with installation of joint sealants under following conditions:
 - a. When ambient and substrate temperature conditions are outside limits permitted by joint sealant manufacturer or are below 4.4 °C (40 °F).
 - b. When joint substrates are wet.
- B. Joint-Width Conditions:
 1. Do not proceed with installation of joint sealants where joint widths are less than those allowed by joint sealant manufacturer for applications indicated.

C. Joint-Substrate Conditions:

1. Do not proceed with installation of joint sealants until contaminants capable of interfering with adhesion are removed from joint substrates.

1.6 DELIVERY, HANDLING, AND STORAGE:

- A. Deliver materials in manufacturers' original unopened containers, with brand names, date of manufacture, shelf life, and material designation clearly marked thereon.
- B. Carefully handle and store to prevent inclusion of foreign materials.
- C. Do not subject to sustained temperatures exceeding 32°C (90°F) or less than 5°C (40°F).

1.7 DEFINITIONS:

- A. Definitions of terms in accordance with ASTM C717 and as specified.
- B. Back-up Rod: A type of sealant backing.
- C. Bond Breakers: A type of sealant backing.
- D. Filler: A sealant backing used behind a back-up

rod. **1.8 WARRANTY:**

- A. Warranty exterior sealing against leaks, adhesion, and cohesive failure, and subject to terms of "Warranty of Construction", FAR clause 52.246-21, except that warranty period shall be extended to two years.
- B. General Warranty: Special warranty specified in this Article shall not deprive Government of other rights Government may have under other provisions of Contract Documents and shall be in addition to, and run concurrent with, other warranties made by Contractor under requirements of Contract Documents.

1.9 APPLICABLE PUBLICATIONS:

- A. Publications listed below form a part of this specification to extent referenced. Publications are referenced in text by basic designation only.
- B. American Society for Testing and Materials (ASTM):
 - C509-06 Elastomeric Cellular Preformed Gasket and Sealing Material.
 - C612-10 Mineral Fiber Block and Board Thermal Insulation.
 - C717-10 Standard Terminology of Building Seals and Sealants.
 - C834-10 Latex Sealants.
 - C919-08.Use of Sealants in Acoustical Applications.

- C920-10 Elastomeric Joint Sealants.
- C1021-08 Laboratories Engaged in Testing of Building Sealants.
- C1193-09 Standard Guide for Use of Joint Sealants.
- C1330-02 (R2007) Cylindrical Sealant Backing for Use with Cold Liquid Applied Sealants.
- D1056-07 Specification for Flexible Cellular Materials—Sponge or Expanded Rubber.
- E84-09 Surface Burning Characteristics of Building Materials.

C. Sealant, Waterproofing and Restoration Institute (SWRI).
The Professionals' Guide

PART 2 - PRODUCTS

2.1 SEALANTS:

A. S-1:

1. ASTM C920, polyurethane or polysulfide.
2. Type M.
3. Class 25.
4. Grade NS.
5. Shore A hardness of 20-40

B. S-2:

1. ASTM C920, polyurethane or polysulfide.
2. Type M.
3. Class 25.
4. Grade P.
5. Shore A hardness of 25-40.

C. S-3:

1. ASTM C920, polyurethane or polysulfide.
2. Type S.
3. Class 25, joint movement range of plus or minus 50 percent.
4. Grade NS.
5. Shore A hardness of 15-25.
6. Minimum elongation of 700 percent.

D. S-4:

1. ASTM C920 polyurethane or polysulfide.
2. Type S.
3. Class 25.
4. Grade NS.

5. Shore A hardness of 25-40.

E. S-5:

1. ASTM C920, polyurethane or polysulfide.
2. Type S.
3. Class 25.
4. Grade P.
5. Shore hardness of 15-45.

F. S-6:

1. ASTM C920, silicone, neutral cure.
2. Type S.
3. Class: Joint movement range of plus 100 percent to minus 50 percent.
4. Grade NS.
5. Shore A hardness of 15-20.
6. Minimum elongation of 1200 percent.

G. S-7:

1. ASTM C920, silicone, neutral cure.
2. Type S.
3. Class 25.
4. Grade NS.
5. Shore A hardness of 25-30.
6. Structural glazing application.

H. S-8:

1. ASTM C920, silicone, acetoxy cure.
2. Type S.
3. Class 25.
4. Grade NS.
5. Shore A hardness of 25-30.
6. Structural glazing application.

I. S-9:

1. ASTM C920 silicone.
2. Type S.
3. Class 25.
4. Grade NS.
5. Shore A hardness of 25-30.
6. Non-yellowing, mildew resistant.

J. S-10:

1. ASTM C920, coal tar extended fuel resistance polyurethane.
2. Type M/S.
3. Class 25.
4. Grade P/NS.
5. Shore A hardness of 15-20.

K. S-11:

1. ASTM C920 polyurethane.
2. Type M/S.
3. Class 25.
4. Grade P/NS.
5. Shore A hardness of 35 to 50.

L. S-12:

1. ASTM C920, polyurethane.
2. Type M/S.
3. Class 25, joint movement range of plus or minus 50 percent.
4. Grade P/NS.
5. Shore A hardness of 25 to

50. 2.2 CAULKING COMPOUND:

- A. C-1: ASTM C834, acrylic latex.
- B. C-2: One component acoustical caulking, non drying, non hardening, synthetic rubber.

2.3 COLOR:

- A. Sealants used with exposed masonry shall match color of mortar joints.
- B. Sealants used with unpainted concrete shall match color of adjacent concrete.
- C. Color of sealants for other locations shall be light gray or aluminum, unless specified otherwise.
- D. Caulking shall be light gray or white, unless specified

otherwise. 2.4 JOINT SEALANT BACKING:

- A. General: Provide sealant backings of material and type that are nonstaining; are compatible with joint substrates, sealants, primers, and other joint fillers; and are approved for applications indicated by sealant manufacturer based on field experience and laboratory testing.
- B. Cylindrical Sealant Backings: ASTM C1330, of type indicated below and of size and density to control sealant depth and otherwise contribute to producing optimum sealant performance:
 1. Type C: Closed-cell material with a surface skin.

- C. Elastomeric Tubing Sealant Backings: Neoprene, butyl, EPDM, or silicone tubing complying with ASTM D1056, nonabsorbent to water and gas, and capable of remaining resilient at temperatures down to minus 32°C (minus 26°F). Provide products with low compression set and of size and shape to provide a secondary seal, to control sealant depth, and otherwise contribute to optimum sealant performance.
- D. Bond-Breaker Tape: Polyethylene tape or other plastic tape recommended by sealant manufacturer for preventing sealant from adhering to rigid, inflexible joint-filler materials or joint surfaces at back of joint where such adhesion would result in sealant failure. Provide self-adhesive tape where applicable.

2.5 FILLER:

- A. Mineral fiber board: ASTM C612, Class 1.
- B. Thickness same as joint width.
- C. Depth to fill void completely behind back-up

rod. 2.6 PRIMER:

- A. As recommended by manufacturer of caulking or sealant material.
- B. Stain free type.

2.7 CLEANERS-NON POUROUS SURFACES:

Chemical cleaners acceptable to manufacturer of sealants and sealant backing material, free of oily residues and other substances capable of staining or harming joint substrates and adjacent non-porous surfaces and formulated to promote adhesion of sealant and substrates.

PART 3 - EXECUTION

3.1 INSPECTION:

- A. Inspect substrate surface for bond breaker contamination and unsound materials at adherent faces of sealant.
- B. Coordinate for repair and resolution of unsound substrate materials.
- C. Inspect for uniform joint widths and that dimensions are within tolerance established by sealant manufacturer.

3.2 PREPARATIONS:

- A. Prepare joints in accordance with manufacturer's instructions and SWRI.
- B. Clean surfaces of joint to receive caulking or sealants leaving joint dry to the touch, free from frost, moisture, grease, oil, wax, lacquer paint, or other foreign matter that would tend to destroy or impair adhesion.
 - 1. Clean porous joint substrate surfaces by brushing, grinding, blast cleaning, mechanical abrading, or a combination of these methods to

- produce a clean, sound substrate capable of developing optimum bond with joint sealants.
2. Remove loose particles remaining from above cleaning operations by vacuuming or blowing out joints with oil-free compressed air. Porous joint surfaces include the following:
 - a. Concrete.
 - b. Masonry.
 - c. Unglazed surfaces of ceramic tile.
 3. Remove laitance and form-release agents from concrete.
 4. Clean nonporous surfaces with chemical cleaners or other means that do not stain, harm substrates, or leave residues capable of interfering with adhesion of joint sealants.
 - a. Metal.
 - b. Glass.
 - c. Porcelain enamel.
 - d. Glazed surfaces of ceramic tile.
- C. Do not cut or damage joint edges.
- D. Apply masking tape to face of surfaces adjacent to joints before applying primers, caulking, or sealing compounds.
 1. Do not leave gaps between ends of sealant backings.
 2. Do not stretch, twist, puncture, or tear sealant backings.
 3. Remove absorbent sealant backings that have become wet before sealant application and replace them with dry materials.
- E. Apply primer to sides of joints wherever required by compound manufacturer's printed instructions.
 1. Apply primer prior to installation of back-up rod or bond breaker tape.
 2. Use brush or other approved means that will reach all parts of joints.
- F. Take all necessary steps to prevent three sided adhesion of sealants.
- 3.3 BACKING INSTALLATION:**
- A. Install back-up material, to form joints enclosed on three sides as required for specified depth of sealant.
 - B. Where deep joints occur, install filler to fill space behind the back-up rod and position the rod at proper depth.
 - C. Cut fillers installed by others to proper depth for installation of back-up rod and sealants.

- D. Install back-up rod, without puncturing the material, to a uniform depth, within plus or minus 3 mm (1/8 inch) for sealant depths specified.
- E. Where space for back-up rod does not exist, install bond breaker tape strip at bottom (or back) of joint so sealant bonds only to two opposing surfaces.
- F. Take all necessary steps to prevent three sided adhesion of sealants.

3.4 SEALANT DEPTHS AND GEOMETRY:

- A. At widths up to 6 mm (1/4 inch), sealant depth equal to width.
- B. At widths over 6 mm (1/4 inch), sealant depth 1/2 of width up to 13 mm (1/2 inch) maximum depth at center of joint with sealant thickness at center of joint approximately 1/2 of depth at adhesion surface.

3.5 INSTALLATION:

- A. General:
 - 1. Apply sealants and caulking only when ambient temperature is between 5°C and 38°C (40° and 100°F).
 - 2. Do not use polysulfide base sealants where sealant may be exposed to fumes from bituminous materials, or where water vapor in continuous contact with cementitious materials may be present.
 - 3. Do not use sealant type listed by manufacture as not suitable for use in locations specified.
 - 4. Apply caulking and sealing compound in accordance with manufacturer's printed instructions.
 - 5. Avoid dropping or smearing compound on adjacent surfaces.
 - 6. Fill joints solidly with compound and finish compound smooth.
 - 7. Tool joints to concave surface unless shown or specified otherwise.
 - 8. Finish paving or floor joints flush unless joint is otherwise detailed.
 - 9. Apply compounds with nozzle size to fit joint width.
 - 10. Test sealants for compatibility with each other and substrate.
Use only compatible sealant.
- B. For application of sealants, follow requirements of ASTM C1193 unless specified otherwise.
- C. Where gypsum board partitions are of sound rated, fire rated, or smoke barrier construction, follow requirements of ASTM C919 only to seal all cut-outs and intersections with the adjoining construction unless specified otherwise.

1. Apply a 6 mm (1/4 inch) minimum bead of sealant each side of runners (tracks), including those used at partition intersections with dissimilar wall construction.
2. Coordinate with application of gypsum board to install sealant immediately prior to application of gypsum board.
3. Partition intersections: Seal edges of face layer of gypsum board abutting intersecting partitions, before taping and finishing or application of veneer plaster-joint reinforcing.
4. Openings: Apply a 6 mm (1/4 inch) bead of sealant around all cutouts to seal openings of electrical boxes, ducts, pipes and similar penetrations. To seal electrical boxes, seal sides and backs.
5. Control Joints: Before control joints are installed, apply sealant in back of control joint to reduce flanking path for sound through control joint.

3.6 CLEANING:

- A. Fresh compound accidentally smeared on adjoining surfaces: Scrape off immediately and rub clean with a solvent as recommended by the caulking or sealant manufacturer.
- B. After filling and finishing joints, remove masking tape.
- C. Leave adjacent surfaces in a clean and unstained

condition. 3.7 LOCATIONS:

- A. Exterior Building Joints, Horizontal and Vertical:
 1. Metal to Metal: Type S-1, S-2
 2. Metal to Masonry: Type S-1
 3. Masonry to Masonry: Type S-1
 4. Cast Stone to Cast Stone: Type S-1
 5. Threshold Setting Bed: Type S-1, S-3, S-4
 6. Masonry Expansion and Control Joints: Type S-6
 7. Wood to Masonry: Type S-1
- B. Metal Reglets and Flashings:
 1. Flashings to Wall: Type S-6
 2. Metal to Metal: Type S-6
- C. Sanitary Joints:
 1. Walls to Plumbing Fixtures: Type S-9
 2. Counter Tops to Walls: Type S-9
 3. Pipe Penetrations: Type S-9
- D. Horizontal Traffic Joints:
 1. Concrete Paving, Unit Pavers: Type S-11 or S-12

E. High Temperature Joints over 204 degrees C (400 degrees F):

1. Exhaust Pipes, Flues, Breech Stacks: Type S-7 or S-8

F. Interior Caulking:

1. Typical Narrow Joint 6 mm, (1/4 inch) or less at Walls and Adjacent Components: Types C-1, C-2 and C-3.
2. Perimeter of Doors, Windows, Access Panels which Adjoin Concrete or Masonry Surfaces: Types C-1, C-2 and C-3.
3. Joints at Masonry Walls and Columns, Piers, Concrete Walls or Exterior Walls: Types C-1, C-2 and C-3.
4. Perimeter of Plaster or Gypsum Wallboard Walls: Types C-1, C-2 and C-3.
5. Exposed Isolation Joints at Top of Full Height Walls: Types C-1, C-2 and C-3.
6. Concealed Acoustic Sealant Type S-4, C-1, C-2 and C-

3. - - - E N D - - -

THIS PAGE INTENTIONALLY LEFT BLANK

**SECTION 08 11 13
HOLLOW METAL DOORS AND FRAMES**

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This section specifies steel doors, steel frames and related components.
- B. Terms relating to steel doors and frames as defined in ANSI A123.1 and as specified.

1.2 RELATED WORK

- A. Aluminum frames entrance work: Section 08 41 13, ALUMINUM-FRAMED ENTRANCES AND STOREFRONTS.
- B. Door Hardware: Section 08 71 00, DOOR HARDWARE.
- C. Glazing: Section 08 80 00, GLAZING.

1.3 TESTING

An independent testing laboratory shall perform testing.

1.4 SUBMITTALS

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Manufacturers Literature and Data:
 - 1. Fire rated doors and frames, showing conformance with NFPA 80 and Underwriters Laboratory, Inc., or Intertek Testing Services or Factory Mutual fire rating requirements and temperature rise rating for stairwell doors. Submit proof of temperature rating.

1.5 SHIPMENT

- A. Prior to shipment label each door and frame to show location, size, door swing and other pertinent information.
- B. Fasten temporary steel spreaders across the bottom of each door frame.

1.6 STORAGE AND HANDLING

- A. Store doors and frames at the site under cover.
- B. Protect from rust and damage during storage and erection until completion.

1.7 APPLICABLE PUBLICATIONS

- A. Publications listed below form a part of this specification to the extent referenced. Publications are referenced in the text by the basic designation only.
- B. Federal Specifications (Fed. Spec.):
 - L-S-125BScreening, Insect, Nonmetallic

C. Door and Hardware Institute (DHI):

A115 Series Steel Door and Frame Preparation for Hardware,
Series A115.1 through A115.17 (Dates Vary)

D. Steel Door Institute (SDI):

113-01 Thermal Transmittance of Steel Door and Frame
Assemblies

128-1997 Acoustical Performance for Steel Door and Frame
Assemblies

A250.8-03 Standard Steel Doors and Frames

E. American Society for Testing and Materials (ASTM):

A167-99(R2004) Stainless and Heat-Resisting Chromium-Nickel
Steel Plate, Sheet, and Strip

A568/568-M-07 Steel, Sheet, Carbon, and High-Strength, Low-
alloy, Hot-Rolled and Cold-Rolled

A1008-08 Steel, sheet, Cold-Rolled, Carbon, Structural,
High Strength Low Alloy and High Strength Low
Alloy with Improved Formability

B209/209M-07 Aluminum and Aluminum-Alloy Sheet and Plate

B221/221M-08 Aluminum and Aluminum-Alloy Extruded Bars,
Rods, Wire, Profiles and Tubes

D1621-04 Compressive Properties of Rigid Cellular
Plastics

D3656-07 Insect Screening and Louver Cloth Woven from
Vinyl Coated Glass Yarns

E90-04 Laboratory Measurement of Airborne Sound
Transmission Loss of Building Partitions

F. The National Association Architectural Metal Manufactures
(NAAMM): Metal Finishes Manual (1988 Edition)

G. National Fire Protection Association (NFPA):

80-09 Fire Doors and Fire Windows

H. Underwriters Laboratories, Inc. (UL):

Fire Resistance Directory

I. Intertek Testing Services (ITS):

Certifications Listings...Latest Edition

J. Factory Mutual System (FM):

Approval Guide

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Stainless Steel: ASTM A167, Type 302 or 304; finish, NAAMM Number 4.
- B. Sheet Steel: ASTM A1008, cold-rolled for panels (face sheets) of doors.
- C. Anchors, Fastenings and Accessories: Fastenings anchors, clips connecting members and sleeves from zinc coated steel.
- D. Aluminum Sheet: ASTM B209/209M.
- E. Aluminum, Extruded: ASTM B221/221M.
- F. Prime Paint: Paint that meets or exceeds the requirements of

A250.8. 2.2 FABRICATION GENERAL

A. GENERAL:

1. Follow SDI A250.8 for fabrication of standard steel doors, except as specified otherwise. Doors to receive hardware specified in Section 08 71 00, DOOR HARDWARE. Tolerances as per SDI A250.8. Thickness, 44 mm (1-3/4 inches), unless otherwise shown.
2. Close top edge of exterior doors flush and seal to prevent water intrusion.
3. When vertical steel stiffeners are used for core construction, fill spaces between stiffeners with mineral fiber insulation.

B. Heavy Duty Doors: SDI A250.8, Level 2, Model 2 of size and design shown. Core construction types a, d, or f, for interior doors, and, types b, c, e, or f, for exterior doors.

C. Fire Rated Doors (Labeled):

1. Conform to NFPA 80 when tested by Underwriters Laboratories, Inc., Inchcape Testing Services, or Factory Mutual for the class of door or door opening shown.
2. Fire rated labels of metal, with raised or incised markings of approving laboratory shall be permanently attached to doors.
3. Close top and vertical edges of doors flush. Vertical edges shall be seamless. Apply steel astragal to the meeting stile of the active leaf of pairs of fire rated doors, except where vertical rod exit devices are specified for both leaves swinging in the same direction.
4. Construct fire rated doors in stairwell enclosures for maximum transmitted temperature rise of 230 °C (450 °F) above ambient temperature at end of 30 minutes of fire exposure when tested in accordance with ASTM E152.

2.3 METAL FRAMES

A. General:

1. SDI A250.8, 1.3 mm (0.053 inch) thick sheet steel, types and styles as shown or scheduled.
2. Frames for exterior doors: Fabricate from 1.7 mm (0.067 inch) thick galvanized steel conforming to ASTM A525.
3. Frames for labeled fire rated doors.
 - a. Comply with NFPA 80. Test by Underwriters Laboratories, Inc., Inchcape Testing Services, or Factory Mutual.
 - b. Fire rated labels of approving laboratory permanently attached to frames as evidence of conformance with these requirements. Provide labels of metal or engraved stamp, with raised or incised markings.
4. Knocked-down frames are not acceptable.

B. Reinforcement and Covers:

1. SDI A250.8 for, minimum thickness of steel reinforcement welded to back of frames.
2. Provide mortar guards securely fastened to back of hardware reinforcements.

C. Glazed Openings and Panel Opening:

1. Integral stop on exterior, corridor, or secure side of door.
2. Design rabbet width and depth to receive glazing material or panel shown or specified.

D. Frame Anchors:

1. Floor anchors:
 - a. Where floor fills occur, provide extension type floor anchors to compensate for depth of fill.
 - b. At bottom of jamb use 1.3 mm (0.053 inch) thick steel clip angles welded to jamb and drilled to receive two 6 mm (1/4 inch) floor bolts. Use 50 mm x 50 mm (2 inch by 2 inch) 9 mm by (3/8 inch) clip angle for lead lined frames, drilled for 9 mm (3/8 inch) floor bolts.
 - c. Where mullions occur, provide 2.3 mm (0.093 inch) thick steel channel anchors, drilled for two 6 mm (1/4 inch) floor bolts and frame anchor screws.

- d. Where sill sections occur, provide continuous 1 mm (0.042 inch) thick steel rough bucks drilled for 6 mm (1/4 inch) floor bolts and frame anchor screws. Space floor bolts at 50 mm (24 inches) on center.
2. Jamb anchors:
- a. Locate anchors on jambs near top and bottom of each frame, and at intermediate points not over 600 mm (24 inches) apart, except for fire rated frames space anchors as required by labeling authority.
 - b. Form jamb anchors of not less than 1 mm (0.042 inch) thick steel unless otherwise specified.
 - c. Anchors for stud partitions: Either weld to frame or use lock-in snap-in type. Provide tabs for securing anchor to the sides of the studs.
 - d. Anchors for frames set in prepared openings:
 - 1) Steel pipe spacers with 6 mm (1/4 inch) inside diameter welded to plate reinforcing at jamb stops or hat shaped formed strap spacers, 50 mm (2 inches) wide, welded to jamb near stop.
 - 2) Drill jamb stop and strap spacers for 6 mm (1/4 inch) flat head bolts to pass thru frame and spacers.
 - e. Modify frame anchors to fit special frame and wall construction and provide special anchors where shown or required.

2.4 TRANSOM PANELS

- A. Fabricate panels as specified for flush doors.
- B. Fabricate bottom edge with rabbet stop to fit top of door where no transom bar occurs.

2.5 SHOP PAINTING

SDI A250.8.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Plumb, align and brace frames securely until permanent anchors are set.
 - 1. Use triangular bracing near each corner on both sides of frames with temporary wood spreaders at midpoint.
 - 2. Use wood spreaders at bottom of frame if the shipping spreader is removed.
 - 3. Protect frame from accidental abuse.

4. Where construction will permit concealment, leave the shipping spreaders in place after installation, otherwise remove the spreaders after the frames are set and anchored.
5. Remove wood spreaders and braces only after the walls are built and jamb anchors are secured.

B. Floor Anchors:

1. Anchor the bottom of door frames to floor with two 6 mm (1/4 inch) diameter expansion bolts. Use 9 mm (3/8 inch) bolts on lead lined frames.
2. Power actuated drive pins may be used to secure frame anchors to concrete floors.

C. Jamb Anchors:

1. Coat frame back with a bituminous coating prior to lining of grout filling in masonry walls.
2. Secure anchors to sides of studs with two fasteners through anchor tabs. Use steel drill screws to steel studs.
3. Frames set in prepared openings of masonry or concrete: Expansion bolt to wall with 6 mm (1/4 inch) expansion bolts through spacers. Where subframes or rough bucks are used, 6 mm (1/4 inch) expansion bolts on 600 mm (24 inch) centers or power activated drive pins 600 mm (24 inches) on centers. Secure two piece frames to subframe or rough buck with machine screws on both faces.

- D. Install anchors for labeled fire rated doors to provide rating as required.

3.2 INSTALLATION OF DOORS AND APPLICATION OF HARDWARE

Install doors and hardware as specified in Section 08 14 00, INTERIOR WOOD DOORS and Section 08 71 00, DOOR HARDWARE.

- - - E N D - - -

**SECTION 08 14 00
WOOD DOORS**

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This section specifies interior paneled stile and rail doors with prefinish, prefit option.
- B. Section includes exterior aluminum clad wood doors, interior stile and rail doors and smoke doors.

1.2 RELATED WORK

- A. Metal door frames: Section 08 11 13, HOLLOW METAL DOORS AND FRAMES.
- B. Overhead doors including loading docks: Section 08 33 00, COILING DOORS AND GRILLES.
- C. Door hardware including hardware location (height): Section 08 71 00, DOOR HARDWARE.
- D. Installation of doors and hardware: Section 08 11 13, HOLLOW METAL DOORS AND FRAMES, Section 08 14 00, WOOD DOORS, or Section 08 71 00, DOOR HARDWARE.
- E. Glazing: Section 08 80 00, GLAZING.
- F. Card readers and biometric devices: Section 28 13 00, ACCESS CONTROL
- G. Security monitors: Section 28 51 00, SECURITY CONTROL

CENTER 1.3 SUBMITTALS

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Samples:
 - 1. Pre-finished door veneer sample 200 mm (8 inch) by 275 mm (11 inch) by 6 mm (1/4 inch) showing factory finish.
 - 2. Aluminum cladding sample.
 - 3. Manufacturer's full line of color samples for selection of interior paneled door.
- C. Shop Drawings:
 - 1. Show every door in project and schedule location in building.
 - 2. Indicate type, grade, finish and size; include detail of glazing, sound gasketing and pertinent details.
 - 3. Provide information concerning specific requirements not included in the manufacturer's literature and data submittal.
- D. Manufacturer's Literature and Data:
 - 1. Sound rated doors, including test report indicating STC rating per ASTM E90 from test laboratory.

E. Laboratory Test Reports:

1. Screw holding capacity test report in accordance with WDMA T.M.10.
2. Split resistance test report in accordance with WDMA T.M.5.
3. Cycle/Slam test report in accordance with WDMA T.M.7.
4. Hinge-Loading test report in accordance with WDMA T.M.8.

1.4 WARRANTY

A. Doors are subject to terms of Article titled "Warranty of Construction", FAR clause 52.246-21, except that warranty shall be as follows:

1. For interior doors, manufacturer's warranty for lifetime of original installation.
2. Specified STC RATING for sound retardant rated door assembly in place.

1.5 DELIVERY AND STORAGE

A. Factory seal doors and accessories in minimum of 6 mill polyethylene bags or cardboard packages which shall remain unbroken during delivery and storage.

B. Store in accordance with WDMA I.S.1-A, J-1 Job Site Information.

C. Label package for door opening where

used. 1.6 APPLICABLE PUBLICATIONS

A. Publications listed below form a part of this specification to extent referenced. Publications are referenced in text by basic designation only.

B. Window and Door Manufacturers Association (WDMA):

- I.S.1-A-04 Architectural Wood Flush Doors
- I.S.4-07A Water-Repellent Preservative Non-Pressure Treatment for Millwork
- I.S.6A-01 Architectural Wood Stile and Rail Doors
- T.M.5-90 Split Resistance Test Method
- T.M.6-08 Adhesive (Glue Bond) Durability Test Method
- T.M.7-08 Cycle-Slam Test Method
- T.M.8-08 Hinge Loading Test Method
- T.M.10-08 Screwholding Test Method

C. National Fire Protection Association (NFPA):

- 80-07 Protection of Buildings from Exterior Fire
- 252-08 Fire Tests of Door Assemblies

- D. ASTM International (ASTM):
E90-04 Laboratory Measurements of Airborne Sound
Transmission Loss

PART 2 - PRODUCTS

2.1 ALUMINUM CLAD WOOD

- A. Meeting requirements of WDMA I.S.6A
- B. Basis-of-Design: Marvin Doors Clad 2 1/4" French door. Douglass fir door with 0.080" (2.0) thick extruded aluminum clad exterior. No panel.
- C. Grade: Premium.
- D. Door:
1. 6" Top Rail.
 2. 24 7/8" Bottom Rail.
 3. 6" Stile.
- E. Stops and Molds:
1. Solid sticking both sides, of same material as stiles and rails, coped at intersections.
 2. Glazed openings applied wood stops nailed on interior side of door.
- F. Finish: Two coat Kynar or Hylar resin
1. Color: Select from manufacturer's full line of colors.
- G. Glass: 11/16" Insulated Low-E Clear (GL-1).
- H. 4 3/4" HM frame with wood trim where indicated on

plans. 2.2 INTERIOR VENEER DOOR

- A. Meeting requirements of ASTM F476-76, 1.S.1A-04
- B. Solid core doors of size and design shown, with laminated finish.
- C. Performance Duty Level: Extra Heavy Duty
- D. Basis-of-Design Product:
1. C/S Acrovyn non-rated and 20-minute rated 2-panel door with replacement stile conforming to WDMA I.S.1A-04.
 2. Raised panels: Unless otherwise shown, thickness of raised panels per manufacturer's standard.
 3. Thickness: 1-3/4"
 4. Crossbanding: FSC Certified .125" Tempered Hardboard.
 5. Replaceable Vertical Edge
 6. Horizontal Edges: Hardwood rails bonded to core.
 7. Door panel design to be chosen from manufacturer's eight standard panel designs ("Berkeley", "Plymouth", etc.).
 8. Panel design is to be present on both door faces.

E. Door Faces:

1. Door faces to be high impact resistant acronym finish.
2. Color: Selected from manufacturer's full line.

F. Door Edges:

1. Finish: Same as door face.
2. Edges are to fully wrap door vertical stiles to eliminate banded edges thus improving durability and impact resistance.
3. Door edges shall not have exposed fasteners to improve appearance.
4. Edges must be flush with face of door thus eliminating raised edges that could be torn off.
5. Edges to include 1/4" radius.

G. Adhesives:

1. Crossbanding to core adhesives shall be Urea Formaldehyde Free Type II Adhesive.
2. Door faces are to be applied to the crossbanded core using Type I Urea Formaldehyde Free Adhesive.

H. Cores:

1. SCL, 38 lb/ft cubed density - no added urea formaldehyde content and 70% Forestry Stewardship Council (FSC).

2.3 PREFINISH, PREFIT OPTION

- A. Doors may be factory machined to receive hardware, bevels, undercuts, cutouts, accessories and fitting for frame.
- B. Factory fitting to conform to specification for shop and field fitting, including factory application of sealer to edge and routings.
- C. Doors to receive transparent finish (in addition to being prefit) shall may be factory finished as follows:
 1. WDMA I.S.1-A Section F-3 specification for System TR-4, Conversion Varnish or System TR-5, Catalyzed Vinyl.
 2. Use stain when required to produce the finish specified in Finish Schedule.

2.4 IDENTIFICATION MARK:

- A. On top edge of door.
- B. Either a stamp, brand or other indelible mark, giving manufacturer's name, door's trade name, construction of door, code date of manufacture and quality.
- C. Accompanied by either of the following additional requirements:

1. An identification mark or a separate certification including name of inspection organization.
 2. Identification of standards for door, including glue type.
 3. Identification of veneer and quality certification.
 4. Identification of preservative treatment for stile and rail doors.
- 2.5 SEALING:**

Give top and bottom edge of doors two coats of catalyzed polyurethane or water resistant sealer before sealing in shipping containers. **PART 3 - EXECUTION**

3.1 DOOR PREPARATION

- A. Field, shop or factory preparation: Do not violate the qualified testing and inspection agency label requirements for fire rated doors.
- B. Clearances between Doors and Frames and Floors:
 1. Maximum 3 mm (1/8 inch) clearance at the jambs, heads, and meeting stiles, and a 19 mm (3/4 inch) clearance at bottom, except as otherwise specified.
 2. Maximum clearance at bottom of sound rated doors, light-proofed doors, doors to operating rooms, and doors designated to be fitted with mechanical seal: 10 mm (3/8 inch).
- C. Provide cutouts for special details required and specified.
- D. Rout doors for hardware using templates and location heights specified in Section, 08 71 00 DOOR HARDWARE.
- E. Fit doors to frame, bevel lock edge of doors 3 mm (1/8 inch) for each 50 mm (two inches) of door thickness.
- F. Immediately after fitting and cutting of doors for hardware, seal cut edges of doors with two coats of water resistant sealer.
- G. Finish surfaces, including both faces, top and bottom and edges of the doors smooth to touch.
- H. Apply a steel astragal on the opposite side of active door on pairs of fire rated doors.
- I. Apply a steel astragal to meeting style of active leaf of pair of doors or double egress smoke doors.

3.2 INSTALLATION OF DOORS APPLICATION OF HARDWARE

Install doors and hardware as specified in this Section.

3.3 DOOR PROTECTION

- A. As door installation is completed, place polyethylene bag or cardboard shipping container over door and tape in place.

B. Provide protective covering over knobs and handles in addition to covering door.

C. Maintain covering in good condition until removal is approved by

COTR. - - - E N D - - -

**SECTION 08 31 13
ACCESS DOORS AND FRAMES**

PART 1 - GENERAL

1.1 DESCRIPTION:

Section specifies access doors or panels.

1.2 RELATED WORK:

- A. Lock Cylinders: Section 08 71 00, DOOR HARDWARE.
- B. Locations of access doors for duct work cleanouts: Section 23 31 00, HVAC DUCTS AND CASINGS and Section 23 37 00, AIR OUTLETS AND INLETS.

1.3 SUBMITTALS:

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Shop Drawings: Access doors, each type, showing construction, location and installation details.
- C. Manufacturer's Literature and Data: Access doors, each type.

1.4 APPLICABLE PUBLICATIONS

- A. Publications listed below form a part of this specification to extent referenced. Publications are referenced in the text by basic designation only.
- B. American Society for Testing and Materials (ASTM):
 - A167-99(R-2004) Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet and Strip
 - A1008-07 Steel Sheet, Cold-Rolled, Carbon, Structural, High Strength Low-Alloy
- C. American Welding Society (AWS):
 - D1.3-98 Structural Welding Code Sheet Steel
- D. National Fire Protection Association (NFPA):
 - 80-06 Fire Doors and Windows
- E. The National Association of Architectural Metal Manufacturers (NAAMM):
 - AMP 500 Series Metal Finishes Manual
- F. Underwriters Laboratories, Inc. (UL):
 - Fire Resistance Directory

PART 2 - PRODUCTS

2.1 FABRICATION, GENERAL

- A. Fabricate components to be straight, square, flat and in same plane where required.
 - 1. Slightly round exposed edges and without burrs, snags and sharp edges.

2. Exposed welds continuous and ground smooth.
 3. Weld in accordance with AWS D1.3.
- B. Number of locks and non-continuous hinges as required to maintain alignment of panel with frame. For fire rated doors, use hinges and locks as required by fire test.
- C. Provide anchors or make provisions in frame for anchoring to adjacent construction. Provide size, number and location of anchors on four sides to secure access door in opening. Provide anchors as required by fire test.

2.2 ACCESS DOORS, FIRE RATED:

- A. Shall meet requirements for "B" label 1-1/2 hours with maximum temperature rise of 120 degree C (250 degrees F).
- B. Comply with NFPA 80 and have Underwriters Laboratories Inc., or other nationally recognized laboratory label for Class B opening.
- C. Door Panel: Form of 0.9 mm (0.0359 inch) thick stainless steel sheet, insulated sandwich type construction.
- D. Frame: Form of 1.5 mm (0.0598 inch) thick steel sheet of depth and configuration to suit material and type of construction where installed. Provide frame flange at perimeter where installed in concrete masonry or gypsum board openings.
1. Weld exposed joints in flange and grind smooth.
 2. Provide frame flange at perimeter where installed in concrete masonry or gypsum board.
- E. Automatic Closing Device: Provide automatic closing device for door.
- F. Hinge: Continuous steel hinge with stainless steel pin.
- G. Lock:
1. Self-latching, with provision for fitting flush a standard screw-in type lock cylinder. Lock cylinder specified in Section 08 71 00, DOOR HARDWARE.
 2. Provide latch release device operable from inside of door. Mortise case in door.

2.3 ACCESS DOORS, FLUSH PANEL:

- A. Door Panel:
1. Form of 1.9 mm (0.0747 inch) thick steel or 1.5 mm (0.0598 inch) thick stainless steel sheet.
 2. Reinforce to maintain flat surface.

B. Frame:

1. Form of 1.5 mm (0.0598 inch) thick steel or stainless steel sheet of depth and configuration to suit material and type of construction where installed.
2. Provide surface mounted units having frame flange at perimeter where installed in concrete, masonry, or gypsum board construction.
3. Weld exposed joints in flange and grind smooth.

C. Hinge:

1. Concealed spring hinge to allow panel to open 175 degrees.
2. Provide removable hinge pin to allow removal of panel from frame.

D. Lock:

1. Flush, screwdriver operated cam lock.

2.4 FINISH:

- A. Provide in accordance with NAAMM AMP 500 series on exposed surfaces.
- B. Steel Surfaces: Baked-on prime coat over a protective phosphate coating.
- C. Stainless Steel: No. 4 in wet areas or ceramic tile surfaces.

2.5 SIZE:

Minimum 600 mm (24 inches) square door unless otherwise shown. **PART 3 - EXECUTION**

3.1 LOCATION:

- A. Provide access panels or doors wherever any valves, traps, dampers, cleanouts, and other control items of mechanical, electrical and conveyor work are concealed in wall or partition, or are above ceiling of gypsum board or plaster.
- B. Use fire rated doors in fire rated partitions and ceilings.
- C. Use flush panels in partitions and gypsum board or plaster ceilings, except lay-in acoustical panel ceilings or upward access acoustical tile ceilings.

3.2 INSTALLATION, GENERAL:

- A. Install access doors in openings to have sides vertical in wall installations, and parallel to ceiling suspension grid or side walls when installed in ceiling.
- B. Set frames so that edge of frames without flanges will finish flush with surrounding finish surfaces.
- C. Set frames with flanges to overlap opening and so that face will be uniformly spaced from the finish surface.

- D. Set recessed panel access doors recessed so that face of surrounding materials will finish on the same plane, when finish in door is installed.

3.3 ANCHORAGE:

- A. Secure frames to adjacent construction using anchors attached to frames or by use of bolts or screws through the frame members.
- B. Type, size and number of anchoring device suitable for the material surrounding the opening, maintain alignment, and resist displacement during normal use of access door.
- C. Anchors for fire rated access doors shall meet requirements of applicable fire test.

3.4 ADJUSTMENT:

- A. Adjust hardware so that door panel will open freely.
- B. Adjust door when closed so door panel is centered in the frame. - - - E N D - - -

**SECTION 08 33 00
COILING DOORS AND GRILLES**

PART 1 - GENERAL

1.1 DESCRIPTION

This section specifies coiling fire doors of sizes shown on Drawings, complete as specified.

1.2 RELATED WORK

A. Field painting: Section 09 91 00, PAINTING.

1.3 MANUFACTURER'S AND INSTALLER'S QUALIFICATIONS

- A. Coiling Fire doors shall be products of manufacturers regularly engaged in manufacturing items of type specified.
- B. Install items under direct supervision of manufacturer's representative or trained personnel.

1.4 FIRE DOOR REQUIREMENTS

Where fire doors exceed the size for which testing and labeling is available, submit certificates stating that the doors and hardware is identical in design, materials, and construction to a door that has been tested and meets the requirements for the class indicated.

1.5 SUBMITTALS

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Shop Drawings:
1. Each type of fire door showing details of construction, accessories and hardware.
- C. Manufacturer's Literature and Data:
1. Brochures or catalog cuts, each type door or grille.
 2. Manufacturer's installation procedures and instructions.
 3. Maintenance instructions, parts lists.
- D. Certificates:
1. Attesting doors, anchors and hardware will withstand the horizontal loads specified.
 2. Attesting oversize fire doors and hardware are identical in design, material, and construction to doors that meet the requirements for the class specified.

1.6 APPLICABLE PUBLICATIONS

- A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.

- B. American Society for Testing and Materials (ASTM):
- A36/A36M-05Structural Steel
 - A167-99(R2004)Stainless and Heat-Resisting Chromium-Nickel
Steel Plate, Sheet and Strip
 - A653/A653M-07 Steel Sheet, Zinc-Coated (Galvanized) Zinc-Iron
Alloy-Coated (Galvannealed) by the Hot-Dip
Process
 - B209/209M-06 Aluminum and Aluminum-Alloy Sheet and Plate
 - B221/B221M-06 Aluminum-Alloy Extruded Bars, Rods, Wire,
Shapes, and Tubes
- C. National Electrical Manufacturers Association (NEMA):
- ICS 1-00(R2005) Industrial Control and Systems General
Requirements
 - ICS 2-00(R2005) Industrial Control, and Systems, Controllers,
Contactors, and Overload Relays
 - ICS 6-93 (R2006) Industrial Control and Systems Enclosures
 - MG 1-06Motors and Generators
 - ST 20-92 (R1997)Dry-Type Transformers for General Applications
- D. Master Painters Institute (MPI):
- MPI #35Exterior Bituminous Coating
 - MPI #76Quick Drying Alkyd Metal Primer
- E. National Fire Protection Association (NFPA):
- 70-07National Electrical Code 1999 Edition
 - 80-06Fire Doors and Fire Windows
- F. National Association of Architectural Metal Manufacturers (NAAMM):
- AMP 500 SeriesMetal Finishes Manual
- G. Underwriters Laboratories, Inc. (UL):
- 2007 Fire Resistance Directory

PART 2 - PRODUCTS

2.1 MATERIAL

- A. Steel: A653 for forming operation. ASTM A36 for structural sections.
- B. Alkyd Metal Primer: MPI No.

76. 2.2 DESIGN REQUIREMENTS

- A. Coiling fire doors shall be spring counter balanced, overhead coiling type, inside face mounted with guides at jambs set back a sufficient distance to provide a clear opening when door is in open position.
- B. Basis-of-Design: The Cookson Company - Simple Test Manual Fire Door.

- C. Fire rated doors shall conform to the requirements specified herein and to NFPA 80 for the class indicated. Doors shall bear Underwriters Laboratories, Inc. label indicating the applicable fire rating.

2.3 FABRICATION

A. Curtains:

1. Form of interlocking slats of galvanized steel of shapes standard with the manufacturer, except that slats for exterior doors shall be flat type.

B. Bottom Bar:

1. Two angles of equal weight, one on each side, standard extruded aluminum members not less than 3 mm (0.125 inch) thick.

C. Barrel and Spring Counterbalance:

1. Curtain shall coil on a barrel supported at end of opening on brackets and be balanced by helical springs.
2. Barrel fabricated of steel pipe or commercial welded steel tubing of proper diameter and thickness for the size of curtain, to limit deflection with curtain rolled up, not to exceed 1 in 400 (0.03 inch per foot) of span.
3. Close ends of barrel with cast iron plugs, machined to fit the opening.
4. Within the barrel, install an oil-tempered, helical, counter balancing steel spring, capable of producing sufficient torque to assure easy operation of the door curtain from any position.
5. At least 80 percent of the door weight shall be counter balanced at any position.
6. Spring-tension shall be adjustable from outside of bracket without removing the hood.

D. Brackets:

1. Steel plate designed to form end closure and support for hood and the end of the barrel assembly.
2. End of barrel or shaft shall screw into bracket hubs fabricated of cast iron or steel.
3. Equip bracket hubs or barrel plugs with prelubricated ball bearings, shielded or sealed.

E. Hoods:

1. Steel galvanized, 0.6 mm (0.0239 inch) thick.
2. Form hood to fit contour of end brackets.
3. Reinforce at top and bottom edges with rolled beads, rods or angles. Hoods more than 3600 mm (12 feet) in length shall have intermediate supporting brackets.
4. Fasten to brackets with screws or bolts and provide for attachment to wall with bolts.

F. Guides:

1. Manufacturer's standard formed sections or angles of steel.
2. Form a channel pocket of sufficient depth to retain the curtain in place under the horizontal pressure specified, and prevent ends of curtain from slipping out of guide slots.
3. Top sections flared for smooth entry of curtain to vertical sections that will facilitate entry of curtain.
4. Provide stops to limit curtain travel above top of guides.
5. Mounting brackets shall provide closure between guides and

jamb. 2.5 MANUAL OPERATORS

A. Hand Chain Operation:

1. Galvanized, endless chain operating over a sprocket and extending to within 900 mm (3 feet) of floor.
2. Obtain reduction by use of suitable permanently lubricated gearing connected by roller chain and sprocket drive.
3. Calculate gear reduction to reduce pull required on hand chain, not to exceed 1676 Pa (35 psf).

B. Crank Operation:

1. Locate crank approximately 854 mm (34 inches) above the floor.
2. Connect vertical shaft, gear box, and gears to curtain.
3. Calculate gear reduction to reduce pressure exerted on crank to not over 958 Pa (20 pounds).

2.6 FIRE DOORS

- A. B-labeled fire doors shall be complete with hardware, accessories, and automatic closing device as required by NFPA 80.
- B. Equip fire doors with an automatic closing mechanism actuated by fusible links to release at 54 °C (130 °F).

- C. Doors shall be forced into a closed position by an auxiliary spring in the barrel which is inoperative during normal operation and when activated will not affect the adjustment of the counterbalance spring. The auxiliary spring shall exert pressure on the curtain until the release device is reset. Door shall come to rest on the floor without impact.
- D. Control descent of curtain by an oscillating governor.
- E. Provide handles for push up operation.

2.7 FINISHES

- A. Steel:
 - 1. Clean surfaces of steel free from scale, rust, oil and grease, and then apply a light colored shop prime paint after fabrication.
 - 2. Non-galvanized steel: Treat to assure maximum paint adherence, and apply corrosion inhibitive primer.
- B. Stainless Steel:
 - 1. Mill finish on concealed surfaces,
 - 2. No. 4 finish on all exposed surfaces.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install fire doors in accordance with approved shop drawings and manufacturer's instructions.
- B. Locate anchors and inserts for guides, brackets, hardware, and other accessories accurately.
- C. Securely attach guides to adjoining construction with not less than 9 mm (3/8 inch) diameter bolts, near each end and spaced not over 600 mm (24 inches) apart.

3.2 REPAIR

- A. Repair prime painted zinc-coated surfaces and bare zinc-coated surfaces that are damaged by the application of galvanizing repair compound. Spot prime all damaged shop prime painted surfaces including repaired prime painted zinc-coated surfaces.
- B. Coiling Fire Doors shall be lubricated, properly adjusted, and demonstrated to operate freely.

3.3 PROTECTION

- A. Isolate aluminum in contact with or fastened to dissimilar metals other than stainless steel, white bronze or other metals not compatible with aluminum by one of the following:
 - 1. Paint the dissimilar metal with a prime coat of zinc-Molybdate or other suitable primer, followed by two coats of aluminum paint.
 - 2. Place an approved caulking compound, or a non-absorptive tape, or gasket between the aluminum and the dissimilar metal.
- B. Paint aluminum in contact with or built into mortar, concrete, plaster or other masonry materials with a coat of bituminous paint.
- C. Paint aluminum in contact with wood or other absorptive materials, that may repeatedly become wet, with a coat of bituminous paint or two coats of aluminum paint.

3.4 INSPECTION

Upon completion, doors shall be free from warp, twist, or distortion.

- - - E N D - - -

SECTION 08 52 00

WOOD WINDOWS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes aluminum-clad wood windows.

1.2 PERFORMANCE REQUIREMENTS

- A. General: Provide wood windows capable of complying with performance requirements indicated, based on testing manufacturer's windows that are representative of those specified, and that are of test size required by AAMA/WDMA 101/I.S.2/NAFS.
- B. Structural Performance: Provide wood windows capable of withstanding the effects of the following loads based on testing units representative of those indicated for Projects that pass AAMA/WDMA 101/I.S.2/NAFS, Uniform Load Structural Test:
 - 1. Design Wind Loads: Determine design wind loads applicable to project from basis wind speed indicated in miles per hour (meters per second) at 33 feet (10 m) above grade, according to ASCE 7, Section 6.5, "Method 2-Analytical Procedure," based on mean roof heights above grade indicated on Drawings.
 - a. Basic Wind Speed: 90 mph (40 m/s).
 - b. Importance Factor: 1.5.
 - c. Exposure Category: C.
 - 2. Deflection: Design glass framing system to limit lateral deflections of glass edges to less than 1/175 of glass-edge length or 3/4 inch (19 mm), whichever is less, at design pressure based on testing performed according to AAMA/WDMA 101/I.S.2/NAFS, Uniform Load Deflection Test or structural computations.
- C. Windborne-Debris Resistance: Provide glazed windows capable of resisting impact from windborne debris, based on the pass/fail criteria as determined from testing glazed windows identical to those specified, according to ASTM E 1886 and testing information in ASTM E 1996 and requirements of authorities having jurisdiction.

1.3 SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings: Include plans, elevations, sections, hardware, accessories, insect screens, operational clearances, and details of installation, including anchor, flashing, and sealant installation, in

accordance with Section 01 33 23 SHOP DRAWINGS, PRODUCT DATA AND SAMPLES.

- C. Samples: For each exposed product and finish.
- D. Product Schedule: For wood windows. Use same designations indicated on Drawings.
- E. Product test reports.
- F. Maintenance data.

1.4 QUALITY ASSURANCE

- A. Installer: A qualified installer, approved by manufacturer to install manufacturer's products.
- B. Manufacturer's Qualifications: A qualified manufacturer who is certified for chain of custody by an FSC-accredited certification body.
- C. Pre-Installation Conference: Conduct conference at project site.

1.5 WARRANTY

- A. Manufacturer's Warranty: Manufacturer agrees to repair or replace wood windows that fail in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to:
 - a. Failure to meet performance requirements.
 - b. Structural failures including excessive deflection, water leakage, air infiltration, or condensation.
 - c. Faulty operation of moveable sash and hardware.
 - d. Deterioration of wood, metals, vinyl, other materials, and finishes beyond normal weathering.
 - e. Failure of insulating glass.
 - 2. Warranty Period:
 - a. Window: 10 years from date of Substantial Completion.
 - b. Glazing Units: 20 years from date of Substantial Completion.
 - c. Aluminum-Cladding Finish: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Basis-of-Design Product: Subject to compliance with requirements, provide: Marvin Windows and Doors Ultimate Double Hung Windows in "Single Hung" and "Picture" window styles; and casement windows, or approved equal product.

2.2 WOOD WINDOWS

- A. Operating Types: As indicated on Drawings.
- B. Frames and Sashes: Clear Ponderosa Pine or other fine-grained wood lumber complying with AAMA/WDMA/CSA 101/I.S.2/A440; kiln dried to a moisture content of not more than 12 percent at time of fabrication; free of visible finger joints, blue stain, knots, pitch pockets, and surface checks larger than 1/32 inch deep by 2 inches wide; water-repellent preservative treated.
 - 1. Exterior Finish: Aluminum-clad wood.
 - a. Aluminum Finish: Manufacturer's standard fluoropolymer two-coat system with fluoropolymer color topcoat containing not less than 70 percent polyvinylidene fluoride resin by weight and complying with AAMA 2605.
 - b. Color: As indicated on Drawings.
 - 2. Interior Finish: Manufacturer's standard color-coated finish.
 - a. Color: As indicated on Drawings.
- C. Insulating-Glass Units: ASTM E 2190.
 - 1. Glass: ASTM C 1036, Type 1, Class 1, q3.
 - a. Tint: Clear or Obscure Low-E Glass per Drawings.
- D. Condensation-Resistance Factor (CRF): Provide windows tested for thermal performance according to AAMA 1503, showing a CRF of 45.
- E. Hardware, General: Manufacturer's standard corrosion-resistant hardware sized to accommodate sash weight and dimensions.
 - 1. Exposed Hardware Color and Finish: Oil rubbed bronze.
- F. Thermal Transmittance: Provide wood windows with a whole 15-MPH (24-km/h) exterior wind velocity and winter wind condition temperatures when tested according to AAMA 1503.
- G. U-Factor: 0.35 BTU/sq. ft. x h x deg F. (2.0 w/sq. m x k).
- H. Solar Heat - Gain Coefficient (SHGC): Provide wood windows with a whole-window SHGC maximum of 0.32, determined according to NFRC 200 procedures.
- I. Hung Window Hardware:
 - 1. Counterbalancing Mechanism: AAMA 902.
 - 2. Locks and Latches: Operated from the inside only.
- J. Weather Stripping: Provide full-perimeter weather stripping for each operable sash unless otherwise indicated.

- K. Fasteners: Noncorrosive and compatible with window members, trim, hardware, anchors, and other components.
 - 1. Exposed Fasteners: Do not use exposed fasteners to the greatest extent possible. For application of hardware, use fasteners that match finish hardware being fastened.

2.3 ACCESSORIES

- A. Clad Special Casing:
 - 1. Provide Marvin Windows and Doors, Kinsley RT (2 part casing) - (A1447/A1448) Aluminum casing, or approved.
 - 2. Provide Marvin Windows and Doors A1453 Clad Sub Sill at all aluminum clad windows.

2.4 INSECT SCREENS

- A. General: Fabricate insect screens to integrate with window frame. Provide screen for each operable exterior sash. Screen wickets are not permitted.
 - 1. Type and Location: Half, outside for single-hung sashes.
- B. Aluminum Frames: Complying with SMA 1004 or SMA 1201.
 - 1. Finish for Exterior Screens: Matching color and finish of cladding.
- C. Glass-Fiber Mesh Fabric: Manufacturer's standard.
 - 1. Mesh Color: Manufacturer's standard.

2.5 FABRICATION

- A. Fabricate wood windows in sizes indicated on plans. Include a complete system for installing and anchoring windows.
- B. Glaze wood windows in the factory.
- C. Weather strip each operable sash to provide weathertight installation.
- D. Provide mullions and cover plates, matching window units, complete with anchors for support to structure and installation of window units. Allow for erection tolerances and provide for movement of window units due to thermal expansion and building deflections. Provide mullions and cover plates capable of withstanding design wind loads of window units.
- E. Complete fabrication, assembly, finishing, hardware application, and other work in the factory to greatest extent possible. Disassemble components only as necessary for shipment and installation. Allow for scribing, trimming, and fitting at Project site.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Comply with manufacturer's written instructions for installing windows, hardware, accessories, and other components. For installation procedures and requirements not addressed in manufacturer's written instructions, comply with installation requirements in ASTM E 2112.
- B. Install windows level, plumb, square, true to line, without distortion, anchored securely in place to structural support, and in proper relation to wall flashing and other adjacent construction to produce weathertight construction.
- C. Adjust operating sashes and hardware for a tight fit at contact points and weather stripping for smooth operation and weathertight closure.
- D. Clean exposed surfaces immediately after installing windows. Remove excess sealants, glazing materials, dirt, and other substances.
- E. Remove and replace sashes if glass has been broken, chipped, cracked, abraded, or damaged during construction period.

- - - E N D - - -

THIS PAGE INTENTIONALLY LEFT BLANK

**SECTION 08 71 00
DOOR HARDWARE**

PART 1 - GENERAL

1.1 DESCRIPTION

Builder's hardware and related items necessary for complete installation and operation of doors.

1.2 RELATED WORK

- A. Application of Hardware: Section 081400 INTERIOR WOOD DOORS and 081113 HOLLOW DOORS AND FRAMES.
- B. Sealant: Section 079200, JOINT SEALANTS.
- C. Painting: Section 099100, PAINTING.

1.3 GENERAL

- A. All hardware shall comply with UFAS, (Uniform Federal Accessible Standards) unless specified otherwise.
- B. Hardware for Labeled Fire Doors and Exit Doors: Hardware shall conform to requirements of NFPA 80 for labeled fire doors and to NFPA 101 for exit doors, as well as to other requirements specified. Provide hardware listed by UL, except where heavier materials, larger sized, or better grades are specified herein under paragraph HARDWARE SETS. In lieu of UL labeling and listing, test reports from a nationally recognized testing agency may be submitted showing that hardware has been tested in accordance with UL test methods and that it conforms to NFPA requirements.
- C. Hardware for application on metal and wood doors and frames shall be made to standard templates. Furnish templates to the fabricator of these items in sufficient time so as not to delay the construction.
- D. Each hardware type shall be of the same manufacturer, except as otherwise specified.

1.4 SUBMITTALS

- A. Submit in accordance with Section 013323, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Hardware Schedule: Contractor is responsible for coordinating and verifying schedule. Prepare and submit hardware schedule in the following form:

Hardware Item	Quantity	Size	Reference Publication Type No.	Finish	Mfr. Name and Catalog No.	UL Mark (if fire rated and listed)	ANSI/BHMA Finish Designation
---------------	----------	------	--------------------------------	--------	---------------------------	------------------------------------	------------------------------

C. Certificate of Compliance and Test Reports: Submit certificates that hardware conforms to the requirements specified herein. Certificates shall be accompanied by copies of reports as referenced. The testing shall have been conducted either in the manufacturer's plant and certified by an independent testing laboratory or conducted in an independent laboratory, within four years of submittal of reports for approval.

1.5 DELIVERY AND MARKING

Deliver items of hardware to job site in their original containers, complete with necessary appurtenances including screws, keys, and instructions.

1.6 INSTRUCTIONS

- A. Hardware Set Symbols on Drawings: Except for protective plates, door stops, mutes, thresholds and the like specified herein, hardware requirements for each door are indicated on drawings by symbols. Symbols for hardware sets consist of letters "HW" followed by a number. Each number designates a set of hardware items applicable to a door type.
- B. Manufacturers' Catalog Number References: Where manufacturers' products are specified herein, products of other manufacturers that are considered equivalent to those specified may be used provided they are approved "equal" products. Manufacturers whose products are specified are identified by abbreviations as follows:

FINISH HARDWARE DATA SHEET: Acceptable Manufacturers.

Butts and Hinges:	Hager, McKinney, Stanley, Ives
Cores	Best*, or small format interchangeable cores to match Best
Lock Sets and Electric Lock Sets:	Schlage, or approved equal
Threshold and Header Bolts:	Stanley, Ives, Trimco, Rockwood
Exit Devices:	Von Duprin*, proprietary manufacturer
Overhead Closers and Electromagnetic Door Holders:	LCN*, Norton*
Stops, Bumpers, Mutes, Door Peeps, and Floor-Wall Holders:	Brookline, Glynn-Johnson, Ives, Quality*, Hager, Rixson*
Door Stripping and Seals:	Pemko, National Guard*, Reese, Zero, Hager
Thresholds:	Pemko, National Guard*, Reese*, Zero, Hager

*Asterisk denotes manufacturers referenced in this specification. See substitution requirements in Division 1 for "or equal" products.

- C. Keying: All cores shall be keyed into the existing facilities Great Grand Master Key System. Provide Best removable cores that are removable only with a control key, without disassembly of knob or lockset. Cylinders and core housings shall accept Best 7 pin cores. The VA will change out the contractor supplied construction cores and exchange with Best for final keyed cores to be keyed to the facilities Great Grand Master Key System.

1.7 APPLICABLE PUBLICATIONS

- A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only. In text, hardware items are referred to by series, types, etc., listed in such specifications and standards, except as otherwise specified.
- B. American Society for Testing and Materials (ASTM):
F883-1997 Padlocks
- C. Builders Hardware Manufacturers Association Inc.
A156.1-1997 Butts and Hinges
A156.2-1996 Bored and Preassembled Locks and Latches
A156.3-1994 Exit Devices (BHMA 701)
A156.4-1992 Door Controls (Closers) (BHMA 301)
A156.5-1992 Auxiliary Locks and Associated Products (BHMA 501)
A156.6-1994 Architectural Door Trim (BHMA 1001)
A156.8-1994 Door Controls-Overhead Stops and Holders (BHMA 311)
A156.13-1994 Mortise Locks and Latches (BHMA 621)
A156.15-1995 Closer Holder Release Devices
A156.16-1997 Auxiliary Hardware
A156.18-1993 Materials and Finishes (BHMA 1301)
A156.21-1996 Thresholds
- D. Steel Door Institute (SDI)
100-1991 Standard Steel Doors and Frames
- E. National Fire Protection Association (NFPA):
80-1995 Standard for Fire Doors and Windows
101-1997 Life Safety Code
- F. Underwriters Laboratories, Inc. (UL):
Building Materials Directory (1998)

PART 2 - PRODUCTS

2.1 BUTT HINGES

- A. ANSI A156.1. The following five knuckle ball bearing types of butt hinges shall be used for the types of doors listed, except where otherwise specified.
1. Exterior Hollow Metal and Aluminum Clad Wood Doors: Type A2112 for doors 900 mm (3 feet) wide or less. Type A2111 for doors over 900 mm (3 feet) wide. Hinges for exterior doors shall have non-removable pins.
 2. Interior Doors: Standard full mortise hinge shall be Type A8112 for doors 900 mm (3 feet) wide or less. Type A8111 for doors over 900 mm (3 feet) wide. Clear swing full mortise hinge shall be Type A8122 for doors 900 mm (3 feet) wide or less. Type A8121 for doors over 900 mm (3 feet) wide.
 3. Labeled Wood Fire Doors: Type A8112 or A8122 for doors 900 mm (3 feet) wide or less. Type A8111 or A8121 for doors over 900 mm (3 feet) wide.
- B. See Articles "MISCELLANEOUS HARDWARE" and "HARDWARE SETS" for pivots and hinges other than butts specified above.

2.2 DOOR CLOSING DEVICES

Closing devices shall be products of one manufacturer.

2.3 OVERHEAD CLOSERS

- A. ANSI A156.4, Grade 1.
- B. Closers shall conform to the following:
1. The closer shall have 50 percent adjustable closing force over minimum value for that closer and have adjustable hydraulic back-check effective between 60 degrees and 85 degrees of door opening.
 2. Closers shall be equipped with adjustable hold-open feature having a range up to 180 degrees, unless otherwise specified. Hold-open arm to include cushion-stop feature.
 3. Size Requirements: Size closer in accordance with manufacturer's printed recommendations. Comply with UFSA and VA accessibility requirements.
 4. Material of closer shall be forged or cast iron or cast aluminum.
 5. Arm, fasteners, and brackets for closer shall have a plated finish over steel, malleable iron or high strength ductile cast iron.
 6. Closers shall have full size metal cover.
 7. Closers shall have adjustable hydraulic back-check and separate valves for closing and latching speed.

8. Closers for stairwell doors and smoke/fire doors held open by electromagnetic hold opens shall not have the adjustable hold-open feature.

9. Closers shall be as noted in the HARDWARE SETS, or approved equal. **2.4 COMBINATION CLOSER - HOLDER**

A. ANSI A156.15. Combination closer-holder with built-in electronic release.

B. Combination closer-holder shall have the following features:

1. Control door closing and latching sequence by hydraulic action.

2. Wiring for 24V DC current. Current draw shall not exceed 0.16 amperes.

3. Double level arm closing action, and adjustable hydraulic back-check.

4. Spring power for closing force shall conform to ANSI A156.4 and have 50% spring power adjustment.

5. Closer Size Requirements:

a. Doors, 900 mm (3 feet) and less in width: Size III closer.

b. Doors over 900 mm (3 feet) and less than 1050 mm (3 feet 6 inches) in width: Size IV closer.

c. Doors 1050 mm (3 feet 6 inches) and over in width: Size V closer.

6. Hold-open mechanism shall hold door open between 85 degrees and 180 degrees depending on wall and frame conditions. Mount device to provide maximum door opening permitted by building construction or equipment.

7. Electronic release shall release door when signaled by smoke detector. Smoke detectors shall not be incorporated as an integral part of door holders. Smoke detectors are specified in the ELECTRICAL Section.

8. All closers to have full size metal

covers. **2.5 DOOR STOPS**

A. ANSI A156.16.

B. Provide door stops wherever an opened door or any item of hardware thereon would strike a wall, column, equipment or other parts of building construction. For metal stud and/or metal furring with dry wall construction provide solid wood backing for mounting door stops. For concrete, masonry or quarry tile construction, use lead expansion shields for mounting door stops.

C. Where cylindrical locks with turn pieces or pushbuttons occur, equip wall bumpers Type L22251 (rubber pads having concave face) to receive turn piece or button.

- D. Substitute floor stops Type L22141 or L22161 as appropriate, when wall bumpers would not provide an effective door stop.
- E. Provide stops Type L22011 or L22181, as applicable for exterior doors.
- F. Omit stops where overhead door hold/stops are required.
- G. Provide appropriate roller bumper for each set of doors (except where closet doors occur) where two doors would interfere with each other in swinging.
- H. Provide appropriate door mounted stop on doors in individual toilets where floor or wall mounted stops cannot be used.
- I. Provide overhead surface applied stop Type C25541, ANSI A156.8 on patient toilet doors in bedrooms where toilet door could come in contact with the bedroom door.
- J. Provide door stops on doors where combination closer magnetic holders are specified.

2.6 OVERHEAD DOOR HOLD/STOP

- A. ANSI Standard A156.8. Overhead door hold/stop shall be of sizes recommended by door hold/stop manufacturer for each width of door. Set overhead door hold/stop for 110 degree opening, unless limited by building construction or equipment.
- B. Overhead door hold/stop shall be Heavy-duty 9 Series as manufactured by Glynn Johnson, or approved equal.

2.7 LOCKS AND LATCHES

- A. ANSI A156.2. Locks and latches for doors 45 mm (13/4 inch) thick or over shall have beveled fronts. Permanent figure eight cores shall be Best 7 pin type. The contractor shall purchase all permanent cores for the new locksets required in this project from Best. Cylinders and core housings for all locksets shall accept Best figure eight removable cores. Figure eight cores shall be removable only with a control key. Construct all cores so that they will be interchangeable into the core housings of all mortise locks, rim locks, cylindrical locks, and any other type lock included in the VA Great Grand Master Key System. Disassembly of lever or lockset shall not be required to remove core from lockset. All locksets or latches on double doors with a fire rated label shall have latch bolts with 19 mm (3/4 inch) throw. All lock cases installed on lead lined doors shall be lead lined before applying final hardware finish. The VA will contact Best at the time when locksets are required to be keyed. Using the permanent cores purchased by the contractor, Best will key these cores to the facility's Great Grand Master Key System and send them directly to the VA for installation.

B. In addition to above requirements, locks and latches shall comply with following requirements:

1. Mortise Lock and Latch Sets: Mortise locksets shall be as noted in HARDWARE SETS, or approved equal. All locksets and latches shall be similar to the Best 15 lever style with rose trim style, escutcheon trim style. Refer to 3.3 HARDWARE SETS for specified function of lock and latch set.
2. Cylindrical Lock And Latch Sets: Levers shall meet ADA (Americans with Disabilities Act) requirements. Cylindrical locksets shall be Best 93K series 4000 Grade 1. All locksets shall have Best 15 lever style with D rose trim style. Refer to 3.3 HARDWARE SETS for specified function of lock and latch set.
3. Auxiliary locks shall be as specified herein under paragraph HARDWARE SETS and conform to ANSI A156.5.

2.8 KEYS

The contractor shall provide to the VA one (1) control key and two (2) operating keys, for each different Best series removable metal construction color-coded core used, prior to installation of locks.

2.9 KEY CABINET

- A. ANSI Standard A156.5. Provide key cabinet made of cold rolled, 1.2 mm (0.0478 inch) thick furniture steel electro-welded. Doors shall have "no sag" continuous brass-pin piano type hinge and be equipped with chrome plated locking door handles, hook cam and two paracentric keys. All locks shall be nickel plated with solid brass pin tumbler cylinder keyed as directed. Key Cabinet and Key Control System shall accommodate all keys for this project plus 25 percent.
- B. Key tags shall consist of two sets: Permanent self-locking and loan key snaphook type with tag colors as follows: Red fiber marker of the permanent self-locking type approximately 32 mm (1 1/4 inch) in diameter engraved with the legend "FILE KEY MUST NOT BE LOANED." Also furnish for each hook a white cloverleaf key marker with snap-hooks engraved with the legend "LOAN KEY."
- C. The manufacturer of the lock cylinders and locks shall attach a key tag to keys of each lock cylinder and shall mark thereon the respective item number and key change number. Provide each group of keys in a key gathering envelope (supplied by Key Cabinet Manufacturer) in which the lock manufacturer shall include the following information: Item number, key change number and door number. The contractor shall furnish the Key Cabinet Manufacturer the hardware and keying schedules and change keys.

D. The Key Cabinet Manufacturer shall set up a three-way cross index system, including master keys, listing the keys alphabetically, the hooks numerically and the key changes numerically on different colored index cards. Index cards shall be typewritten and inserted in a durable binder. Attach the keys to the two sets of numbered tags supplied with the cabinet. (The permanent tag and the loan key tag). Instruct the owner in proper use of the system. Install cabinet as directed by the COTR.

2.10 ARMOR PLATES, COMBINATION KICK-MOP PLATES AND DOOR EDGING

A. ANSI Standard A156.6.

B. Provide protective plates and door edging as specified below:

1. Kick-mop plates and armor plates metal, Type J100 series, 1.6 mm (.062 inch) minimum gauge metal, with beveled edges.

a) Provide kick-mop plates for both sides of each new door, except where noted as not required. Kick-mop plates shall be 254 mm (10 inches) high. On push side of doors where jamb stop extends to floor, make combination kick-mop plates 38 mm (1 1/2 inches) less than width of door, except pairs of metal doors which shall have plates 25 mm (1 inch) less than width of each door. Extend all other combination kick-mop plates to within 6 mm (1/4 inch) of each edge of doors. Kick mop plates shall butt astragals. For jamb stop requirements, see specification sections pertaining to doorframes.

b) Kick-mop plates are not required on following door sides:

Armor plate side of doors

Exterior side of exterior doors

Closet side of closet doors

Storage side of doors to or from storage spaces

Both sides of aluminum entrance doors

c) Armor plate for doors is listed under Article " HARDWARE SETS ". Armor plates shall be 875 mm (35 inches) high and 38 mm (1 1/2 inches) less than width of doors, except on pairs of metal doors. Plates on pairs of metal doors shall be 25 mm (1 inch) less than width of each door. Where top of intermediate rail of door is less than 875 mm (35 inches) from door bottom, extend armor plates to within 13 mm (1/2 inch) of top rail. On doors equipped with panic devices, extend armor plates to within 13 mm (1/2 inch) of panic bolt cross bar.

- d) Where louver or grille occurs in lower portion of doors, substitute stretcher plate and kick-mop plate in place of armor plate. Size of stretcher plate and kick-mop plate shall be 200 mm (8 inches) high.
- 2. Door edging metal, Type J200 series, 1.3 mm (.050 inch) minimum gauge metal. Provide 'U' shaped channels at both edges of each armor plated wood door. Install channels with 22 mm (7/8 inch) leg on faces of door and extend full thickness of door mortised into the edge. Stagger screws for securing channels 400 mm (eight inches) on centers in door edges. Extend channels from bottom of door to top of door and cut out for butt hinges and flush bolts specified for the door. Armor plates shall overlap door edging.

2.11 EXIT DEVICES

- A. ANSI Standard A156.3. Exit devices shall be Grade 1; type and function are specified in hardware sets. Provide flush with finished floor strikes for vertical rod exit devices in interior of building. Trim shall have lever handles similar to locksets, unless otherwise specified.
- B. Exit devices for fire doors shall comply with Underwriters Laboratories, Inc., requirements for Fire Exit Hardware. Submit proof of compliance.
- C. Exit device shall be as noted in HARDWARE SETS, or approved equal. Refer to 3.3 HARDWARE SETS for specified functions and options for exit device.

2.12 FLUSH BOLTS (LEVER EXTENSION)

- A. Not Used

2.13 DOOR PULLS

ANSI A156.6. Pull handle and plate metal. Pull handle, Type J400 series, 19 mm (3/4 inch) diameter base, 57 mm (2 1/4 inch) projection, 38 mm (1 1/2 inch) clearance, 203 mm (8 inches) length center to center. Plate metal, Type J300 series, 1.3 mm (.050 inch) minimum gauge metal, 102 mm (4 inches) wide by 406 mm (16 inches) high, square corners beveled. Secure plates to wood doors with 38 mm (1 1/2 inch) long No. 12 wood screws. Cut plates of door pulls for cylinders, or turn pieces where required.

2.14 PUSH PLATES

ANSI A156.6. Plate metal, Type J300 series, 1.3 mm (.050 inch) minimum gauge metal, 203 mm (8 inches) wide by 406 mm (16 inches) high, square corners beveled, unless otherwise specified. Provide metal plate 152 mm (6 inches) wide where push plates are specified for doors with stiles

between 229 mm (9 inches) and 203 mm (8 inches) wide, and 102 mm (4 inches) wide where push plates are specified for doors with stiles less than 203 mm (8 inches) wide. Cut plates for cylinders, and turn pieces where required.

2.15 COMBINATION PUSH AND PULL PLATES

ANSI 156.6. Type J303, metal, 3 mm (1/8 inch) thick, 89 mm (3 1/2 inches) wide by 406 mm (16 inches) high, top and bottom edges shall be rounded. Secure plates to wood doors with 38 mm (1 1/2 inch) long No. 12 wood screws. Cut plates for turn pieces, and cylinders where required. Pull shall be mounted down.

2.16 COORDINATORS

- A. ANSI A156.16. Coordinators, when specified for fire doors, shall comply with Underwriters Laboratories, Inc., requirements for fire door hardware. Coordinator shall be full width of doorframe opening. Coordinate with door configuration and other hardware required for openings using coordinator.
- B. Coordinator may be omitted on exterior pairs of doors where either door will close independently regardless of the position of the other door.
- C. Coordinator may be omitted on interior pairs of non-labeled doors where open back strike is used. Open back strike shall not be used on labeled doors.
- D. COR series coordinator and FB filler length as required. BX mounting brackets as required. Manufactured by Glynn-Johnson or approved equal.

2.17 THRESHOLDS

- A. Exterior Metal Thresholds: ANSI A156, 4 except as otherwise specified. Thresholds shall be installed in a bed of sealant with machine screws and expansion shields. For sealant see Section, SEALANT AND CAULKING. Furnish thresholds where following conditions occur.
 - 1. Exterior openings at entrance for wheel chair use: Threshold No. 713 CP as manufactured by National Guard Products Inc. or approved equal. Threshold shall be 178 mm (7 inches) wide by length of opening.
 - 2. Exterior openings having doors hung on floor hinges: Threshold Type C38081.
 - 3. Exterior openings having doors equipped with vertical rod type panic devices and hung on butt hinges: Threshold No. S250 AC as manufactured by Reese Enterprise, Inc. or approved equal.
- B. Interior Metal Thresholds: ANSI A156.6, Type J601, without stop, fabricated of extruded aluminum. Cut thresholds to closely fit jambs. Drill and cut for door holders and bottom bolts where required. Anchor

with 6 mm by 50 mm (1/4 inch by 2 inches), countersunk, flathead machine screws, with expansion shields, two at each end at intermediate points not over 300 mm (12 inches) on centers. For caulking of thresholds see Section, JOINT SEALANTS.

- C. For thresholds at elevator entrances see other sections of specifications.

2.18 AUTOMATIC DOOR BOTTOM SEAL AND RUBBER GASKET

Automatic door bottom seals as noted in the HARDWARE SETS shall have an exposed case or housing of extruded aluminum, 1.5 mm (0.063 inch) thick with chemically etched medium matte finish, clear anodized .01 mm (0.4 mils) thick, to match finish specified for hardware on door. Automatic door bottom shall be National Guard Products Series 420 or approved equal. Parts other than those specified above shall be zinc or nylon, except that operating springs shall be of spring steel. Housing shall contain operating mechanism consisting of removable metal strip having lower edge of heavy felt or closed cell sponge neoprene. When strip is activated by rod protruding from door bottom, strip shall lift when door is opened and drops to floor when door is closed, providing a light proof seal at bottom of door.

2.19 WEATHERSTRIPS (FOR EXTERIOR DOORS)

- A. Heads and Jambs: Provide closed cell sponge neoprene or silicone strips 29 mm (1-1/8 inches) wide by 5 mm (3/16 inch) thick with beveled edge, extruded aluminum retainer 1.8 mm (0.070 inch) thick by 32 mm (1-1/4 inches).
- B. Heads with parallel arm mounted door closer: Provide seals with aluminum retainer to allow closer and overhead holder to attach to frame through weatherseal section and maintain a continuous seal with no breaks. National Guard Products 700SA or equal.
- C. Meeting Stiles of Pairs of Doors: Provide astragal consisting of two beveled edge solid neoprene strips 3 mm (1/8 inch) thick with extruded aluminum retainers, 1.8 mm by (0.070 inch) thick by 32 mm (1 1/4 inches wide).
- D. Raindrips: Provide and install extruded aluminum 22 mm (0.88 inch) thick raindrips with 63 mm (2 1/2 inch) projection at heads of door frames not protected by canopy or soffit.
- E. Door Bottoms: Provide curved vinyl strips with extruded aluminum retainer similar to No. 14R as manufactured by National Guard Products, Inc. or approved equal.

2.20 MISCELLANEOUS HARDWARE

- A. Access Doors (including Sheet Metal, Screen and Woven Wire Mesh Types):
Except for fire-rated doors and doors to Temperature Control Cabinets, equip each single or double metal access door with Lock Type E76213, conforming to ANSI A156.5. Key locks as directed. Ship lock prepaid to the door manufacturer. Door manufacturer shall provide hinges.
- B. Cylinders for Various Partitions and Doors: Key cylinders same as entrance doors of area in which partitions and door occur, except as otherwise specified.
- C. Mutes: ANSI A156.16. Provide door mutes or door silencers Type 1337A, of white or light gray color, on each new steel door frame. Furnish 3 mutes for single doors and 2 mutes for each pair of doors, except double-acting smoke doors. Mute ASR 64 A as manufactured by Ives or approved equal.

2.20 PADLOCKS FOR VARIOUS DOORS, GATES AND HATCHES

- A. Fed. Spec. FF-P-101, Type EPC, size 50 mm (2 inch) wide chain; furnish extended shackles as required by job conditions. Provide padlocks, with Best removable figure eight core, for each door in following areas as noted.
- B. Key padlocks as follows:
 - 1. Roof Access: Engineer's set.

2.21 ELECTROMAGNETIC DOOR HOLDER

ANSI A156.15. Provide standard profile recessed wall mounted electromagnetic door holder. Provide electromagnetic lock as indicated in HARDWARE SETS, or approved equal. Hardware supplier to verify door hardware depth verses electromagnetic door holder depth.

2.22 FINISHES

- A. Exposed surfaces of hardware shall have BHMA Standard 1301, finishes as specified below. Finishes on all hinges, pivots, closers, thresholds, etc., shall be as specified below under "Miscellaneous Finishes." For field painting (final coat) of ferrous hardware, see Section, PAINTING.
- B. US10B/613 (oxidized and satin bronze, oil rubbed) finish: All surfaces on exterior and interior of buildings, except where other finishes are specified.
- C. Miscellaneous Finishes:
 - 1. Exterior Doors: Color: US10B/613
 - 2. Interior Doors (except inside restrooms): Color: US10B/613.
 - 3. Interior Doors inside restrooms: Color: US26D/626.
 - 4. Door Closers: Factory applied painted finish to match hardware.

5. Thresholds: Dark bronze anodized aluminum to match door.
6. Cover plates for floor hinges and pivots: Match door trim.
7. Other primed steel hardware: US26D/626-652 (Satin Chrome), or US32D/630 (Satin Stainless Steel).

PART 3 - EXECUTION

3.1 HARDWARE HEIGHTS

- A. For new buildings locate hardware on doors at heights specified below:
- B. Hardware Heights From Finished Floor:
 1. Exit devices install per manufacturer's template.
 2. Locksets and latch sets centerline of strike 1000 mm (40-5/16 inches).
 3. Deadlocks centerline of strike 1200 mm (48 inches).
 4. Hospital arm pull 1170 mm (46 inches) to centerline of bottom supporting bracket.
 5. Centerline of door pulls to be 1000 mm (40 inches).
 6. Push plates and push-pull shall be 1250 mm (50 inches) to top of plate.
 7. Push-pull latch to be 1000 mm (40-5/16 inches) to centerline of strike.
 8. Centerline of deadlock strike to be 840 mm (33 inches) when used with push-pull latch.
 9. Locate other hardware at standard commercial heights. Locate push and pull plates to prevent conflict with other hardware.

3.2 INSTALLATION

- A. Closer devices, including those with hold-open features, shall be equipped and mounted to provide maximum door opening permitted by building construction or equipment. Where closers are mounted on doors they shall be mounted with machine screws to solid blocking; foot shall be fastened to frame with machine screws. Closer shall be installed on room side of door so that closer will not be visible from the corridor when door is closed.

B. Hinge Size Requirements:

Thickness of Door	Width of Door	Height of Hinge
45 mm (1-3/4 inch)	900 mm (3 feet) and less	113 mm (4 1/2 inches)
45 mm (1-3/4 inch)	Over 900 mm (3 feet) but not more than 1200 mm (4 feet)	113 mm (4 1/2 inches)

C. Hinge leaves shall be sufficiently wide to allow doors to swing clear of doorframe trim.

D. Where new hinges are specified for new doors in existing frames or existing doors in new frames, sizes of new hinges shall match sizes of existing hinges. Contractor may reuse existing hinges provided hinges meet specified type and style of new hinge and are restored to satisfactory operating condition as approved by COTR. Existing hinges shall not be reused on door openings having new doors and new frames. Coordinate preparation for hinge cut-outs and screw hole locations on doors and frames.

E. Hinges Required Per Door:

Doors over 1500 mm (5 ft) high and not over 2280 mm (7 ft 6 in) high and 900 mm (3 feet) wide and less	3 butts
Doors over 1500 mm (5 ft) high and not over 2280 mm (7 ft 6 in) high and over 900 mm (3 feet) but not more than 1200 mm (4 feet)	4 butts
Doors over 2280 mm (7 feet 6 inches) high	4 butts

F. Fastenings: Suitable size and type and shall harmonize with hardware as to material and finish. Provide machine screws and lead expansion shields to secure hardware to concrete, ceramic or quarry floor tile, or solid masonry. Fiber or rawl plugs and adhesives are not permitted. All fastenings exposed to weather shall be of nonferrous metal.

G. After locks have been installed; show in presence of COTR that the locksets operate their respective lock function in accordance with requirements. Installation of locks, which do not meet specified function requirements, shall be considered sufficient justification for rejection and replacement of locksets installed on project.

3.3 HARDWARE SETS

Following sets of hardware correspond to hardware symbols shown on drawings. Where hardware set for a single door is specified for a pair of doors; equip each leaf of such pair of doors with set noted. Only those hardware sets that are shown on drawings will be required.

HARDWARE SCHEDULE - BUILDING A

A-C11	HW-09
A-C13	HW-09
A100	HW-08
A101	HW-12
A101A	HW-07
A103	HW-11
A103A	HW-15
A104	HW-22
A104A	HW-04
A105	HW-20
A105A	HW-17
A106	HW-22
A107	HW-20
A107A	HW-17
A108	HW-14
A108A	HW-17
A109	HW-01
A110	HW-21
A111	HW-21
A112	HW-05
A113	HW-14
A113A	HW-17
A114	HW-10
A114A	HW-15
A115	HW-14
A115A	HW-17
A116	HW-14
A116A	HW-17
A117	HW-16
A118	HW-01
A119	HW-14
A119A	HW-17
A120	HW-02
A121	HW-14
A121A	HW-17
A122	HW-18
A123A	HW-07
A124	HW-19
A125	HW-03
A126	HW-14
A126A	HW-17
A127	HW-14

A127A	HW-17
A128	HW-14
A128A	HW-17
A129	HW-14
A129A	HW-17
A200	HW-23
A200A	HW-23
A200B	HW-23
A200	HW-23
A200A	HW-23

HARDWARE SCHEDULE – BUILDING B

Door Number	HwSet
B-C11	HW-09
B-C13	HW-09
B100	HW-08
B100A	HW-06
B101	HW-12
B101A	HW-07
B103	HW-11
B103A	HW-15
B104	HW-22
B104A	HW-04
B105	HW-20
B105A	HW-17
B106	HW-22
B107	HW-20
B107A	HW-17
B108	HW-14
B108A	HW-17
B109	HW-01
B110	HW-21
B111	HW-21
B112	HW-05
B113	HW-14
B113A	HW-17
B114	HW-10
B114A	HW-15

B115	HW-14
B115A	HW-17
B116	HW-14
B116A	HW-17
B117	HW-16
B118	HW-01
B120	HW-02
B121	HW-14
B121A	HW-17
B122	HW-18
B123	HW-12
B123A	HW-07
B124	HW-19
B125	HW-03
B126	HW-14
B126A	HW-17
B127	HW-14
B127A	HW-17
B128	HW-20
B128A	HW-17
B200	HW-08
B201	HW-12
B201A	HW-07
B203	HW-11
B203A	HW-15
B204	HW-22
B204A	HW-04
B205	HW-20
B205A	HW-17
B206	HW-22
B207	HW-20
B207A	HW-17
B208	HW-14
B208A	HW-17
B209	HW-01
B210	HW-21

HARDWARE SETS

HW SET: HW-01

PRIVACY (WOOD), NON-RATED

DOOR NUMBER:

A109 A118 B109 B118 B209 B218

EACH TO HAVE:

3	EA HINGE	5BB1 4.5 X 4.5	613 IVE
1	EA PRIVACY LOCK	L9496GD 06A X L583-375	613/ SCH 626
1	EA SURFACE CLOSER	4041 X TB	613 LCN
1	EA WALL STOP	WS407CCV	613 IVE
1	SET SEALS	2525B	BRN NGP
1	EA THRESHOLD	STONE (BY OTHERS)	B/O

HW SET: HW-02

HOME OFFICE (WOOD), NON-RATED

DOOR NUMBER:

A120 B120 B220

EACH TO HAVE:

3	EA HINGE	5BB1 4.5 X 4.5	613 IVE
1	EA CLASSROOM LOCK	L9070GD 06A	613 SCH
1	EA WALL STOP	WS407CCV	613 IVE
1	EA DBL WARDROBE HOOK	582B	613 IVE
3	EA SILENCER	SR64	GRY IVE

HW SET: HW-03

HOME GYM (WOOD), NON-RATED

DOOR NUMBER:

A125 B125

EACH TO HAVE:

3	EA HINGE	5BB1 4.5 X 4.5	613 IVE
1	EA CLASSROOM LOCK	L9070GD 06A	613 SCH
1	EA WALL STOP	WS407CCV	613 IVE
3	EA SILENCER	SR64	GRY IVE

HW SET: HW-04

CLEAN STORAGE (WOOD) - NON-RATED

DOOR NUMBER:

A104A B104A B204A

EACH TO HAVE:

1	EA CONTINUOUS HINGE	224HD	613 IVE
1	EA STOREROOM LOCK	L9080GD 06A	613 SCH
1	EA SURFACE CLOSER	4041 X TB	613 LCN
1	EA OVERHEAD STOP	900S	613 GLY
1	EA ARMOR PLATE	8400 34" X 2" LDW	613 IVE
1	EA EDGE GUARD	BY OTHERS	613 B/O
3	EA SILENCER	SR64	GRY IVE

HW SET: HW-05

STOREROOM (WOOD) - NON-RATED

DOOR NUMBER:

A112 B112 B212 B225

EACH TO HAVE:

3	EA HINGE	5BB1 4.5 X 4.5	613	IVE
1	EA STOREROOM LOCK	L9080GD 06A	613	SCH
1	EA KICK PLATE	8400 10" X 2" LDW	613	IVE
1	EA WALL STOP	WS407CCV	613	IVE
3	EA SILENCER	SR64	GRY	IVE

HW SET: HW-06

STOREROOM (HM) - RATED

DOOR NUMBER:

B100A

EACH TO HAVE:

3	EA HINGE	5BB1 4.5 X 4.5 NRP	613	IVE
1	EA STOREROOM LOCK	L9080GD 06A	613	SCH
1	EA SURFACE CLOSER	4041 SCUSH X TB	613	LCN
1	SET SEALS	160S	CL	NGP
1	EA DOOR SWEEP	C627A	CL	NGP
1	EA THRESHOLD	425HD	AL	NGP

HW SET: HW-07

VESTIBULE (WOOD) - NON-RATED, PAIR

DOOR NUMBER:

A101A A123A B101A B123A B201A

EACH TO HAVE:

6	EA HINGE	5BB1HW 4.5 X 4.5 NRP	613	IVE
1	EA ELECTROMAGNETIC LOCK	M490DEP	613	SCE
2	EA PUSH PLATE	8200 6" X 16"	613	IVE
2	EA PULL PLATE	8305-0 4" X 16"	613	IVE
1	EA AUTO. OPERATOR	9563 REG2	613	LCN
2	EA KICK PLATE	8400 10" X 2" LDW	613	IVE
2	EA SILENCER	SR64	GRY	IVE

1	EA OPTION BOARD	900-8P FA	SCE
1	EA POWER SUPPLY	PS902	SCE
2	EA ACTUATOR, WALL MOUNT	8310-853	LCN
1	EA SCANNER	SCAN II-B	BLK SCE
1	SET WIRING DIAGRAMS	POINT TO POINT, RISER, AND ELEVATION	SCE

ACTUATOR, WIRING, SENSORS, POWER, CONTROL PANEL, CONDUIT. BOTH DOORS ARE SECURED IN PLACE WITH MAGNETIC LOCKS. DOORS WILL HAVE A DELAYED EGRESS.

DOORS CAN BE OPENED WITH DELAY, BY TRIGGERING OVERHEAD MOTION SENSOR OR BY DEPRESSING ACTUATOR.

DOORS WILL OPEN IMMEDIATELY UPON FIRE ALARM OR LOSS OF POWER.

INTERIOR AND EXTERIOR OPERATORS OPEN IN SERIES (WITH DELAY FROM INTERIOR ACTUATOR ONLY). BOTH LEAFS IN EACH PAIR OPEN SIMULTANEOUSLY. COORDINATE ACTUATOR LOCATIONS WITH ARCHITECT.

HW SET: HW-08

MECHANICAL (HM) - RATED

DOOR NUMBER:

A100 B100 B200

EACH TO HAVE:

3	EA HINGE	5BB1 4.5 X 4.5 NRP	613	IVE
1	EA STOREROOM LOCK	L9080GD 06A	613	SCH
1	EA SURFACE CLOSER	4041 SCUSH X TB	613	LCN
1	SET SEALS	160S	CL	NGP
1	EA DOOR SWEEP	C627A	CL	NGP
1	EA THRESHOLD	425HD	AL	NGP

HW SET: HW-09

CROSS CORRIDOR (WOOD) - 20 MIN (SMOKE BARRIER), PAIR

DOOR NUMBER:

A-C11 A-C13 B-C11 B-C13

EACH TO HAVE:

2	EA	CONTINUOUS HINGE	224HD	613	IVE
2	EA	FIRE EXIT HARDWARE	9847L-BE-F-LBR 996L-BE	613	VON
1	EA	MORTISE CYLINDER	80-302	613	SCH
2	EA	SURFACE CLOSER	4041 EDA X TB	613	LCN
2	EA	HOLD-OPEN MAGNET	993 X LESS SWITCH	690	RIX
2	EA	KICK PLATE	8400 10" X 2" LDW	613	IVE
2	EA	EDGE GUARD	BY OTHERS	613	B/O
2	EA	WALL STOP	WS407CCV	613	IVE
2	SET	SEALS	160S	CL	NGP
2	EA	ASTRAGAL SEAL	A617A	CL	NGP
1	EA	KEYSWITCH	653-04	630	SCE

MAGNETIC HOLD OPEN TO RELEASE UPON FIRE ALARM OR KEYSWITCH.

HW SET: HW-10

EXIT (HM) - NON-RATED

DOOR NUMBER:

A114 B114 B214

EACH TO HAVE:

3	EA	HINGE	5BB1 4.5 X 4.5 NRP	613	IVE
1	EA	POWER TRANSFER	EPT-2	613	VON
1	EA	PANIC HARDWARE	QEL9847NL	613	VON
1	EA	MORTISE CYLINDER	80-302	613	SCH
1	EA	SURFACE CLOSER	4041 CUSH X TB	613	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW	613	IVE
1	SET	SEALS	700SA	CL	NGP
1	EA	DOOR SWEEP	C627A	CL	NGP
1	EA	THRESHOLD	425HD	613	NGP
1	EA	SMART CARD READER	BY DIVISION 28		HID

ENTRANCE BY CARD READER.

HW SET: HW-11

ROLLING FIRE DOOR

DOOR NUMBER:

A103 B103 B203

EACH TO HAVE:

ALL HARDWARE BY DOOR MANUFACTURER B/O

HW SET: HW-12

ENTRANCE (ALUM. CLAD WOOD) - NON RATED, PAIR

DOOR NUMBER:

A101 B101 B123 B201 B223

EACH TO HAVE:

6	EA	HINGE	5BB1HW 4.5 X 4.5 NRP	613	IVE
2	EA	POWER TRANSFER	EPT-2	613	VON
1	EA	PANIC HARDWARE	QEL9847DT	613	VON
1	EA	PANIC HARDWARE	QEL9847NL	613	VON
1	EA	MORTISE CYLINDER	80-302	613	SCH
1	EA	RIM CYLINDER	80-329	613	SCH
1	EA	MULLION SEAL	5100	BLK	NGP
1	EA	AUTO. OPERATOR	9563 REG2	613	LCN
2	EA	OVERHEAD STOP	100S-ADJ	613	GLY
2	EA	KICK PLATE	8400 10" X 2" LDW	613	IVE
1	SET	SEALS	700SA	CL	NGP
2	EA	DOOR SWEEP	C627A	CL	NGP
1	EA	THRESHOLD	425HD	613	NGP
1	EA	OPTION BOARD	900-2Q		SCE
1	EA	POWER SUPPLY	PS902		SCE
1	EA	ACTUATOR, WALL MOUNT	8310-853		LCN
1	EA	SMART CARD READER	BY DIVISION 28		HID
1	SET	WIRING DIAGRAMS	POINT TO POINT, RISER, AND ELEVATION		SCE

AFTER HOURS ENTRANCE BY CARD READER. CARD READER SHUNTS INTERIOR MAGNETIC LOCK FOR IMMEDIATE ENTRY.

EXTERIOR ACTUATOR IS TURNED OFF AFTER HOURS BY ACCESS CONTROL SYSTEM.

INTERIOR AND EXTERIOR OPERATORS OPEN IN SERIES (WITH DELAY FROM INTERIOR ACTUATOR ONLY). BOTH LEAFS IN EACH PAIR OPEN SIMULTANEOUSLY. COORDINATE ACTUATOR LOCATIONS WITH ARCHITECT.

HW SET: HW-13

NOT USED

HW SET: HW-14

RESIDENT ROOM (WD) - NON-RATED

DOOR NUMBER:

A108	A113	A115	A116	A119	A121
A126	A127	A128	A129	B108	B113
B115	B116	B121	B126	B127	B208
B213	B215	B216	B221	B226	B227

EACH TO HAVE:

2	EA	HINGE	5BB1 4.5 X 4.5	613	IVE
1	EA	ELECTRIC HINGE	5BB1 4.5 X 4.5 TW8	613	IVE
1	EA	ELECTRONIC LOCK	AD-300-CY-50-SM-RHO-GD	643e	SCE
1	EA	WALL STOP	WS407CCV	613	IVE
3	EA	SILENCER	SR64	GRY	IVE
1	EA	VIEWER	U696B	613	IVE

DOOR UNLOCKS CAN UNLOCK UPON PIN CODE, SMART CARD, OR SMART CARD WITH PIN CODE.

POWER AND PANEL INTERFACE BOARD (IF REQ'D) TO BE SUPPLIED AS PART OF THE ACCESS CONTROL SYSTEM.

HW SET: HW-15

VESTIBULE (WD) - NON-RATED

DOOR NUMBER:

A103A A114A B103A B114A B203A B214A

EACH TO HAVE:

3	EA	HINGE	5BB1HW 4.5 X 4.5 NRP	613	IVE
1	EA	ELECTROMAGNETIC LOCK	M490DEP	613	SCE
1	EA	PUSH PLATE	8200 6" X 16"	613	IVE
1	EA	PULL PLATE	8305-0 4" X 16"	613	IVE
1	EA	SURFACE CLOSER	4041 X TB	613	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW	613	IVE
1	EA	WALL STOP	WS407CCV	613	IVE
3	EA	SILENCER	SR64	GRY	IVE
1	EA	AUTO. OPERATOR	9563 REG2	613	LCN
1	EA	OPTION BOARD	900-8P FA		SCE
1	EA	POWER SUPPLY	PS902		SCE
2	EA	ACTUATOR, WALL MOUNT	8310-853		LCN
1	EA	SCANNER	SCAN II-B	BLK	SCE
1	SET	WIRING DIAGRAMS	POINT TO POINT, RISER, AND ELEVATION		SCE

HW SET: HW-16

LAUNDRY (WD) - NON-RATED

DOOR NUMBER:

A117 B117 B217

EACH TO HAVE:

3	EA	HINGE	5BB1 4.5 X 4.5	613	IVE
1	EA	PASSAGE SET	L9010 06A	613	SCH
1	EA	OVERHEAD STOP	900S-J	613	GLY
1	SET	SEALS	160S	CL	NGP
1	EA	THRESHOLD	STONE (BY OTHERS)		B/O

HW SET: HW-17

RESIDENT TOILET (WD) - NON-RATED

DOOR NUMBER:

A105A	A107A	A108A	A113A	A115A	A116A
A119A	A121A	A126A	A127A	A128A	A129A
B105A	B107A	B108A	B113A	B115A	B116A
B121A	B126A	B127A	B128A	B205A	B207A
B208A	B213A	B215A	B216A	B221A	B226A
B227A	B228A				

EACH TO HAVE:

3	EA HINGE	5BB1 4.5 X 4.5 NRP	652 IVE
1	EA PRIVACY SET	L9044 06A	626/6 SCH 13
1	EA OVERHEAD STOP	100S-ADJ	630 GLY
1	EA THRESHOLD	STONE (BY OTHERS)	B/O
1	EA DBL WARDROBE HOOK	582B	626 IVE
3	EA SILENCER	SR64	GRY IVE

HW SET: HW-18

TOILET (WD) - NON-RATED

DOOR NUMBER:

A122	B122	B222
------	------	------

EACH TO HAVE:

3	EA HINGE	5BB1 4.5 X 4.5	652 IVE
1	EA PRIVACY LOCK	L9496GD 06A X L583-375	626/6 SCH 13
1	EA OVERHEAD STOP	100S-ADJ	630 GLY
1	SET SEALS	2525B	BRN NGP
1	EA THRESHOLD	STONE (BY OTHERS)	B/O
1	EA DBL WARDROBE HOOK	582B	626 IVE

HW SET: HW-19

DEN (WD) - NON-RATED

DOOR NUMBER:

A124 B124 B224

EACH TO HAVE:

3	EA HINGE	5BB1 4.5 X 4.5	613 IVE
1	EA PASSAGE SET	L9010 06A	613 SCH
1	EA WALL STOP	WS407CCV	613 IVE
3	EA SILENCER	SR64	GRY IVE

HW SET: HW-20

RESIDENT ROOM (WD) - NON-RATED, PAIR

DOOR NUMBER:

A105 A107 B105 B107 B128 B205
B207 B228

EACH TO HAVE:

5	EA HINGE	5BB1 4.5 X 4.5	613 IVE
1	EA ELECTRIC HINGE	5BB1 4.5 X 4.5 TW8	613 IVE
1	SET AUTO FLUSH BOLT	FB41P	613 IVE
1	EA ELECTRONIC LOCK	AD-300-CY-50-SM-RHO-GD	643e SCE
1	EA COORDINATOR	COR X FL (BRACKETS AS REQ'D)	613 IVE
1	EA ASTRAGAL	139SP	613 NGP
2	EA SURFACE CLOSER	4041 X TB	613 LCN
2	EA WALL STOP	WS407CCV	613 IVE
1	EA THRESHOLD	STONE (BY OTHERS)	B/O
2	EA SILENCER	SR64	GRY IVE
1	EA VIEWER	U696B	613 IVE

DOOR UNLOCKS CAN UNLOCK UPON PIN CODE, SMART CARD, OR SMART CARD WITH PIN CODE.

POWER AND PANEL INTERFACE BOARD (IF REQ'D) TO BE SUPPLIED AS PART OF THE ACCESS CONTROL SYSTEM.

HW SET: HW-21

LINEN (WD) - NON-RATED

DOOR NUMBER:

A110	A111	B110	B111	B210	B211
------	------	------	------	------	------

EACH TO HAVE:

1	EA	CONTINUOUS HINGE	224HD TW8	613	IVE
1	EA	ELECTRONIC LOCK	AD-300-CY-70-KP-RHO-GD	613	SCE
1	EA	SURFACE CLOSER	4041 X TB	613	LCN
1	EA	ARMOR PLATE	8400 34" X 2" LDW	613	IVE
1	EA	EDGE GUARD	BY OTHERS	613	B/O
1	EA	WALL STOP	WS407CCV	613	IVE
3	EA	SILENCER	SR64	GRY	IVE

DOOR UNLOCKS CAN UNLOCK UPON PIN CODE, SMART CARD, OR SMART CARD WITH PIN CODE.

POWER AND PANEL INTERFACE BOARD (IF REQ'D) TO BE SUPPLIED AS PART OF THE ACCESS CONTROL SYSTEM.

HW SET: HW-22

PHARMACY (WD) - NON-RATED

DOOR NUMBER:

A104	A106	B104	B106	B204	B206
------	------	------	------	------	------

EACH TO HAVE:

2	EA	HINGE	5BB1 4.5 X 4.5	613	IVE
1	EA	ELECTRIC HINGE	5BB1 4.5 X 4.5 TW8	613	IVE
1	EA	ELECTRONIC LOCK	AD-300-CY-70-KP-RHO-GD	643e	SCE
1	EA	SURFACE CLOSER	4041 X TB	613	LCN
1	EA	ARMOR PLATE	8400 34" X 2" LDW	613	IVE
1	EA	EDGE GUARD	BY OTHERS	613	B/O
1	EA	WALL STOP	WS407CCV	613	IVE

1	EA THRESHOLD	STONE (BY OTHERS)	B/O
3	EA SILENCER	SR64	GRY IVE
1	EA DOOR POSITION SWITCH 679-05		SCE

DOOR UNLOCKS CAN UNLOCK UPON PIN CODE, SMART CARD, OR SMART CARD WITH PIN CODE.

POWER AND PANEL INTERFACE BOARD (IF REQ'D) TO BE SUPPLIED AS PART OF THE ACCESS CONTROL SYSTEM.

HW SET: HW-23

ROOF TOP ACCESS DOOR (HM)

DOOR NUMBER:

A200	A200A	A200B	B300A	B300B
------	-------	-------	-------	-------

EACH TO HAVE:

3	EA HINGE	5BB1 4.5 X 4.5 NRP	613	IVE
1	EA STOREROOM LOCK	L9080GD 06A	613	SCH
1	EA SURFACE CLOSER	4041 HCUSH	613	LCN
1	EA KICK PLATE	8400 10" X 2" LDW	613	IVE
1	SET SEALS	700SA	CL	NGP
1	EA DRIP CAP	16A	CL	NGP
1	EA DOOR SWEEP	C627A	CL	NGP
1	EA THRESHOLD	425HD	AL	NGP

- - - E N D - - -

SECTION 08 71 13.11
LOW ENERGY POWER ASSIST DOOR OPERATORS

PART 1 - GENERAL

1.1 DESCRIPTION

This section specifies low energy power assisted automatic operation of swing doors. The door operator system shall be complete including operator, controls, door arm and operator enclosure (header and cover). 1.2 RELATED WORK

- A. Sealants; Section 07 92 00, JOINT SEALANTS.
- B. Steel doors; Section 08 11 13, HOLLOW METAL DOORS AND FRAMES.
- C. Wood doors; Section 08 14 00, INTERIOR WOOD DOORS.
- D. Aluminum frames entrance work; Section 08 41 13, ALUMINUM-FRAMED ENTRANCES AND STOREFRONTS.
- E. Door hardware; Section 08 71 00, DOOR HARDWARE.
- F. Glass and glazing of doors and frames; Section 08 80 00, GLAZING.
- G. Smoke detectors for control of fire/smoke doors to be wired per Section 28 31 00, FIRE DETECTION AND ALARM.
- H. Electric general wiring, connections and equipment requirements; Division 26, ELECTRICAL.

1.3 MANUFACTURER'S QUALIFICATIONS

- A. Power assisted door operators, controls and other equipment shall be products of a manufacturer regularly engaged in manufacturing such equipment for a minimum of three years.
- B. One manufacturer of automatic door equipment shall be used throughout the project.

1.4 WARRANTY

Power assisted door operators, controls and other related equipment shall be subject to the terms of the "Warranty of Construction", FAR clause 52.246-21, except that the warranty period shall be two years in lieu of one year.

1.5 MAINTENANCE MANUALS

In accordance with Section 01 00 00, GENERAL REQUIREMENTS Article titled "INSTRUCTIONS," furnish two copies of maintenance manuals and instructions on automatic door operators.

1.6 SUBMITTALS

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Manufacturer's literature and data describing operators, power units, controls, door hardware and safety devices.
- C. Shop Drawings:
Showing location of controls and safety devices in relationship to each automatically operated door. This includes templates, wiring diagrams, fabrication details, anchorage and other information to providers of related work to coordinate the proper installation of the door operators.

1.7 DESIGN CRITERIA

- A. Power assisted automatic door equipment shall accommodate normal traffic as well as the weight of the doors.
- B. Equipment: UL approved and comply with applicable codes. Motors shall be rated minimum one-quarter horsepower and shall be single phase and 115 volts.
- C. Electrical Wiring; Provide wiring so that only a single power supply is required. Equipment and wiring shall be as specified in Division 26, ELECTRICAL.

1.8 APPLICABLE PUBLICATIONS

- A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.
- B. American National Standards Institute (ANSI):
 ICC/ANSI A117.1-03 Guideline for Accessible and Usable
 Buildings
 and Facilities-Providing Accessibility and Usability
 for Physically Handicapped People B. Builders Hardware
 Manufacturers Association, Inc. (BHMA):
 156.19-07 Power Assist and Low Energy Power Operated
 Doors

PART 2 - PRODUCTS

2.1 OPERATORS

- A. Automatic door operators shall be for commercial doors and shall be electromechanical and surface mounted above the door to the header or transom bar. The opening force shall be generated by a permanent magnet DC motor driving a combination spiral bevel/spur gear reducer and transmitted to the door through an arm linkage. Opening speed shall be

adjustable and feature dual backcheck control allowing adjustment of backcheck speed and position. Closing shall be by spring force generated by a metal compression spring. The spring shall reduce manual opening force to not more than 67 N (15 lbf). The minimum diameter of spring wire shall be .007mm (172 in.). Under the specified design load of the door, the spring shall be capable of performing 2,000,000 cycles before fracture. Adjustable closing speed and fixed latch speed shall control the door in the closing cycle. The doors shall be operated manually at any time without damage to the operator or components.

B. All operators shall have checking mechanism providing cushioning action at last part of door travel, in both opening and closing cycle. Operators shall recycle doors instantaneously to full open position from any point in closing cycle when control switch is reactivated.

C. Operator shall be swinging type enclosed in housing. Operator shall open door by energizing motor and shall stop by electrically reducing voltage and stalling motor against mechanical stop. Door shall close by means of spring energy, and close force shall be controlled by gear system and motor being used as dynamic break without power. System shall operate as manual door control in event of power failure.

Opening and closing speeds shall be adjustable:

1. Swing Operator Housing: Housing shall be 140 mm (5-1/2 inches) wide by 150 mm (6 inches) high aluminum extrusions with enclosed end caps for application to 100 mm (4 inch) and larger frame systems. All structural sections shall have a minimum thickness of 3.7 mm (0.146 inch) and be fabricated of 6063-T5 aluminum alloy.
2. Swing Power Operator: Completely assembled and sealed unit which shall include helical gear drive transmission, mechanical spring and bearings, all located in cast aluminum case and filled with special lubricant for extreme temperature conditions. A "DC" shunt-wound permanent magnet motor with sealed ball bearings shall be attached to transmission system. Complete unit shall be rubber mounted with provisions for easy maintenance and replacement, without removing door from pivots or frame.

3. Connecting hardware for swing overhead concealed type power operator shall have drive arm attached to door with a pin linkage rotating in a self-lubricating bearing and adjustable slide block, traveling in an interconnected track and top pivot assembly. Top track and pivot assembly shall be fabricated of steel. Door shall not pivot on shaft of operator.
4. Electrical Control: Operator shall have a self contained electrical control unit, including necessary transformers, relays, rectifiers, and other electronic components for proper operation and switching of power operator. Relays shall be plug-in type for individual replacement and all connecting harnesses shall have interlocking plugs. Control shall also include time delay for normal cycle. Swing door control shall include safe-swing circuit with optional switching which automatically limits power and slows door when approached from the doors swing area.
5. On pairs of doors, operators shall allow either door to be opened manually without the other door opening.

2.2 MICROPROCESSOR CONTROLS

- A. The system shall include a multi-function microprocessor control providing adjustable hold open time (1 - 30 sec.), LED indications for actual position unknown, system status, open obstruction shutdown, activation signal, safety mat/sensor signal, Stop-and-Hold signal, and mode selector switches providing a means for easy field selection of the following functions: push-to-operate, latch assist and stack pressure. Control shall be capable of receiving activation signals from any device with normally open dry contact output.
 1. With push-to-operate function enabled, the control shall provide a means of initiating a self-start activation circuit by slightly pushing the door open at any point in the door swing.
 2. Latch Assist shall provide a two second impulse in the close direction to overcome restrictions with locking devices of pressure differentials, allowing the unit to operate in standard time delay mode, and permitting the door to close from the full open position after the hold time is satisfied. All activation modes shall provide fully adjustable opening speed.

- B. The door shall be held open by low voltage applied to the continuous duty motor. The control shall include an adjustable safety circuit that monitors door operation and shuts the motor off if an open obstruction is sensed. The control shall include a recycle feature that reopens the door if an obstruction is sensed at any point during its closing cycle. The control shall include a standard three position toggle switch with functions for ON, OFF, and HOLD OPEN.

2.3 ENCLOSURE

Operator shall be completely self-contained within an extruded aluminum housing (alloy 6063-T6) to conceal operator mechanism and mounting brackets and with removable access cover with an overall maximum size of 140 mm (5-1/2 inches) wide by 150 mm (6 inches) deep. Header color shall be integral color anodized/painted to match adjacent storefront/frame finish.

2.4 ACTIVATION DEVICES

- A. Automatic: Opening cycle shall be activated by pressing switches with international symbol of accessibility and "PRESS TO OPERATE DOOR" engraved on the faceplate. Switches shall be installed in a standard 2-gang electrical wall box and placed in a location in compliance with ANSI A117.1. Switches may be wall mounted or mounted on a free standing post or guard rail.
- B. Manual: Push-to-operate; manually pushing the door shall activate the automatic opening cycle. Door shall automatically close after timer delay expires.
- C. Opening and closing force, measured 25 mm (1 inch) out from the lock stile of the door, shall not exceed 67 N (15 lbf) to stop the door when operating in either direction or cycle.
- D. Opening Time: Doors shall be field adjusted so that opening time to back check or 80 degrees, whichever occurs first, shall be 3 seconds or longer as required in Table 1. Backcheck shall not occur before 60 degrees opening.
Total opening time to fully open shall be as in Table II.
- E. Closing Time:
Doors shall be field adjusted to close from 90 degrees to 10 degrees in 3 seconds or longer as required in Table 1.
 - 1. Doors shall be field adjusted to close from 10 degrees to fully close position in not less than 1.5 seconds.

2. Doors shall be field adjusted to remain fully open for not less than 5 seconds.
3. Table 1 provides speed settings for various widths and weights of doors for obtaining results complying with this paragraph.

F. Cycle Tests:

1. Low Energy Power Operated, Low Energy Power Open and Power Assist Operators shall be cycle tested for 300,000 cycles.
2. Use the widest and heaviest door specified as a test specimen. Narrower or lighter doors of the same configurations shall then be considered to meet the cycle test requirements.

Table 1

Minimum Opening Time to Backcheck or 80 degrees, which ever occurs first and the Minimum Closing Time from 90 degrees to Latch Check or 10 degrees.

"D" Door Leaf Width- mm (inches)	"W" Door Weight in kg (pounds)				
	(100) 45.4	(56.7) 125	(68.0) 150	(79.4) 175	(90.7) 200
(762) 30	3.0	3.0	3.0	3.0	3.5
(914) 36	3.0	3.5	3.5	4.0	4.0
(1067) 42	3.5	4.0	4.0	4.5	4.5

Doors of other weights and widths can be calculated using the formula;

$$T = DvW/133 \text{ in US units} \quad T = DvW/2260 \text{ in SI (metric) units}$$

Where: T= Time, seconds

D= Door width, mm (inches)

W= Door weight, kg (lbs)

The values for "T" time have been rounded up to the nearest half second.

These values are based on a kinetic energy of (1.25 lbf-ft).

Table II

Total Opening Time to Full Open Position

Backcheck at 60 degrees	Backcheck at 70 degrees	Backcheck at 80 degrees
Table 1 plus 2 seconds	Table 1 plus 1.5 seconds	Table 1 plus 1 second

Note: To determine maximum times from close to full open, the operator shall be adjusted as shown in the chart. Backcheck occurring at a point between positions in Table II shall use the lowest setting. For example, if the backcheck occurs at 75 degrees, the full open shall be the time shown in Table 1 plus 1.5 seconds.

2.5 POWER UNITS

Provide separate self-contained electric circuits for automatic operators located on each floor of the building. Interruption or failure of power circuits for operators located on one floor of the building shall not interfere with continuous performance of automatic operated doors located on other floors. Capacity and size of power circuits shall be in accordance with automatic operator manufacturer's specifications.

2.6 SAFETY DEVICES

- A. Time delay switches shall be adjustable between 5 to 60 seconds and shall control closing cycle of doors.
- B. Decals with sign "In" or "Do Not Enter" shall be installed on both faces of each door where shown and shall conform to the requirements of ANSI/BHMA A156.19.
- C. Each swing door shall have installed a motion sensor to detect any person standing in the door swing path and prevent the door from opening.
- D. Motion sensors shall consist of detection modules, factory prepared to be attached to each side of the lock/strike stile, an armored flex link power cable and bracket assembly, factory prepared for attachment to the pivot stile; a logic board and a position encoder which shall mount to the operator. The detection modules shall contain transmitting and receiving diodes and sense multidimensional zones for detection of people and/or objects in the door area. Detection modules shall be high impact, shock resistant zinc castings with tinted lenses. The swing door sensor system shall provide complete operate and safety zone coverage. These zones shall be fully adjusted to meet specific jobsite

conditions (sidewalls, adjacent panels, etc.) The system shall not be affected by ultrasonic, ambient light or radios frequencies within the vicinity of the swing door.

- E. Each swing door shall have installed a re-activation sensor mounted on the push-side door face near the top detect any person standing in the door swing path and prevent the door from closing. Wiring for the reactivation sensor between the door and frame shall be concealed in a power transfer device, hinge or pivot provided under Section 08 71 00; wire chase in door provided under door section.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Coordinate installation of equipment with other related work. Manual controls and power disconnect switches shall be recessed or semi-flush mounted in partitions. Secure operator components to adjacent construction with suitable fastenings. Conceal conduits, piping, and electric equipment in finish work.
- B. Install power units in locations shown. Where units are to be mounted on walls, provide metal supports or shelves for the units. All equipment, including time delay switches, shall be accessible for maintenance and adjustment.
- C. Operators shall be adjusted and must function properly for the type of traffic (pedestrians) expected to pass through doors. Each door leaf of pairs of doors shall open and close in synchronization. On pairs of doors, operators shall allow either door to be opened manually without the other door opening.
- D. Install controls at positions shown and make them convenient for particular traffic expected to pass through openings. Maximum height of push plate wall switches from finished floors shall be 40 inches unless otherwise approved by the COTR.

---- END ----

**SECTION 08 80 00
GLAZING**

PART 1 - GENERAL

1.1 DESCRIPTION

This section specifies glass, related glazing materials and accessories. Glazing products specified apply to factory or field glazed items.

1.2 RELATED WORK

A. Factory glazed by manufacturer in following units:

1. Sound resistant doors: Section 08 11 13, HOLLOW METAL DOORS AND FRAMES, and Section 08 14 00, WOOD DOORS.
2. Mirrors: Section 10 28 00, TOILET, BATH, AND LAUNDRY ACCESSORIES.
3. Section 08 52 00 WOOD WINDOWS.
4. Section 08 41 13 ALUMINUM-FRAMED ENTRANCES AND STOREFRONTS.
5. Section 28 13 11, PHYSICAL ACCESS CONTROL SYSTEMS.

1.3 LABELS

A. Temporary labels:

1. Provide temporary label on each light of glass identifying manufacturer or brand and glass type, quality and nominal thickness.
2. Label in accordance with NFRC (National Fenestration Rating Council) label requirements.
3. Temporary labels shall remain intact until glass is approved by COTR.

B. Permanent labels:

1. Locate in corner for each pane.
2. Label in accordance with ANSI Z97.1 and SGCC (Safety Glass Certification Council) label requirements.
 - a. Tempered glass.
 - b. Organic coated glass.

1.4 PERFORMANCE REQUIREMENTS

A. Building Enclosure Vapor Retarder and Air Barrier:

1. Utilize the inner pane of multiple pane sealed units for the continuity of the air barrier and vapor retarder seal.
2. Maintain a continuous air barrier and vapor retarder throughout the glazed assembly from glass pane to heel bead of glazing sealant.

B. Glass Thickness:

1. Select thickness of exterior glass to withstand dead loads and wind loads acting normal to plane of glass at design pressures calculated in accordance with ASCE 7 applicable code.
2. Test in accordance with ASTM E 1300.
3. Thicknesses listed are minimum. Coordinate thicknesses with framing system manufacturers.

1.5 SUBMITTALS

A. In accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

B. Manufacturer's Certificates:

1. Certificate on shading coefficient.

C. Warranty: Submit written guaranty, conforming to General Condition requirements, and to "Warranty of Construction" Article in this Section.

D. Manufacturer's Literature and Data:

1. Glass, each kind required.
2. Insulating glass units.
3. Elastic compound for metal sash glazing.
4. Putty, for wood sash glazing.
5. Sealing compound.

E. Samples:

1. Size: 150 mm by 150 mm (6 inches by 6 inches).
2. GL-1: Clear Low 'E' Insulated Glass
3. GL-2: 1/4" Clear Glass
4. GL-3: Insulated Obscure Glass
5. GL-4: Solid Polymer Panels - Patina finish
6. GL-5: Solid Polymer Panels - Patent finish

F. Preconstruction Adhesion and Compatibility Test Report: Submit glazing sealant manufacturer's test report indicating glazing sealants were tested for adhesion to glass and glazing channel substrates and for compatibility with glass and other glazing materials.

1.6 DELIVERY, STORAGE AND HANDLING

A. Delivery: Schedule delivery to coincide with glazing schedules so minimum handling of crates is required. Do not open crates except as required for inspection for shipping damage.

- B. Storage: Store cases according to printed instructions on case, in areas least subject to traffic or falling objects. Keep storage area clean and dry.
- C. Handling: Unpack cases following printed instructions on case. Stack individual windows on edge leaned slightly against upright supports with separators between each.

1.7 PROJECT CONDITIONS

Field Measurements: Field measure openings before ordering tempered glass products. Be responsible for proper fit of field measured products.

1.8 WARRANTY

- A. Warranty: Conform to terms of "Warranty of Construction", FAR clause 52.246-21, except extend warranty period for the following:
 1. Insulating glass units to remain sealed for 10 years.
 2. Laminated glass units to remain laminated for 5 years.
 3. Polycarbonate to remain clear and ultraviolet light stabilized for 5 years.
 4. Obscure glass units for five years.
 5. Patterned glass units: Repair or replace units that fair in material or workmanship for a period of one year from ship date.

1.9 APPLICABLE PUBLICATIONS

- A. Publications listed below form a part of this specification to extent referenced. Publications are referenced in text by basic designation only.
- B. American National Standards Institute (ANSI):
 - Z97.1-04 Safety Glazing Material Used in Building - Safety Performance Specifications and Methods of Test.
- C. American Society for Testing and Materials (ASTM):
 - C1363-05 Thermal Performance of Building Assemblies, by Means of A Hot Box Apparatus
 - C542-05 Lock-Strip Gaskets.
 - C716-06 Installing Lock-Strip Gaskets and Infill Glazing Materials.
 - C794-06 Adhesion-in-Peel of Elastomeric Joint Sealants.
 - C864-05 Dense Elastomeric Compression Seal Gaskets, Setting Blocks, and Spacers.
 - C920-08 Elastomeric Joint Sealants.

- C964-07 Standard Guide for Lock-Strip Gasket Glazing.
- C1036-06 Flat Glass.
- C1048-04 Heat-Treated Flat Glass-Kind HS, Kind FT Coated
and Uncoated Glass.
- C1376-10 Pyrolytic and Vacuum Deposition Coatings on
Flat Glass.
- E84-09 Surface Burning Characteristics of Building
Materials.
- E1300-09 Determining Load Resistance of Glass in
Buildings.
- E2190-08 Insulating Glass Unit
- D. Code of Federal Regulations (CFR):
16 CFR 1201 - Safety Standard for Architectural Glazing Materials;
1977, with 1984 Revision.
- E. National Fire Protection Association (NFPA):
80-08 Fire Doors and Windows.
- F. National Fenestration Rating Council (NFRC)
- G. Safety Glazing Certification Council (SGCC)2009:
Certified Products Directory (Issued Semi-Annually).
- H. Unified Facilities Criteria (UFC):
4-010-01-2007 DOD Minimum Antiterrorism Standards for
Buildings
- I. Glass Association of North America (GANA):
Glazing Manual (Latest Edition)
Sealant Manual (2008)
- J. American Society of Civil Engineers (ASCE):
ASCE 7-10 Wind Load Provisions

PART 2 - PRODUCT

2.1 GLASS

- A. Use thickness stated unless specified otherwise in assemblies.
- B. Clear Glass (GL-2):
1. ASTM C1036, Type I, Class 1, Quality q3.
 2. Thickness, 6 mm (1/4 inch).
 3. Coordinate color, tint and coating to accommodate required security monitoring.
- C. Tinted Heat reflective and low emissivity coated glass:
1. ASTM C1036, Type I, Class 2, Quality q3.
 2. Color: Clear.

3. Thickness, 6 mm (1/4 inch).

2.2 HEAT-TREATED GLASS

A. Clear Heat Strengthened Glass:

1. ASTM C1048, Kind HS, Condition A, Type I, Class 1, Quality q3.
2. Thickness, 6 mm (1/4 inch).

B. Tinted Heat Strengthened Glass:

1. ASTM C1048, Kind HS, Condition A, Type I, Class 2, Quality q3.
2. Color: Clear.
3. Thickness, 6 mm (1/4 inch).

C. Clear Tempered Glass:

1. ASTM C1048, Kind FT, Condition A, Type I, Class 1, Quality q3.
2. Thickness, 6 mm (1/4 inch).

2.3 INSULATING GLASS UNITS (GL-1)

- A. Provide factory fabricated, hermetically sealed glass unit consisting of two panes of glass separated by a dehydrated air space and comply with ASTM E2190.

B. Assemble units using glass types specified:

C. Sealed Edge Units (SEU)(Installed Aluminum Storefront Framed Units):

1. Insulating Glass Unit Makeup

a. Outboard Lite

1. Basis-of-Design: Pilkington Solar-ETM Solar Control, Low-E (#2), or approved equal.
2. Glass type: Class 1 (Clear) Low-E.
3. Glass Tint: Clear.
4. Nominal Thickness: 6 mm (1/4 inch).
5. Glass Strength: Heat-Strengthened, Tempered (where required).
6. Coating Orientation: Surface #2.

b. Spacer

1. Nominal Thickness: 13 mm (1/2 inch)
2. Gas Fill: (90% Argon)

c. Inboard Lite

1. Basis-of-Design: Pilkington Optifloat Clear, or approved equal.
2. Glass Type: Class 1 (Clear).
3. Glass Tint: Clear.
4. Nominal Thickness: 6 mm (1/4 inch)
5. Glass Strength: (Heat-Strengthened, Tempered, where required)

2. Performance Characteristics (Center of Glass):

- a. Visible Transmittance: 53%
 - b. Visible Exterior Reflectance: 11%
 - c. Visible Interior Reflectance: 15%
 - d. Winter U-factor (U-value): .29
 - e. Shading Coefficient (SC): .51
 - f. Solar heat Gain Coefficient (SHGC): .45
- 3. Glass shall be heat strengthened or tempered as required by codes, or as required to meet thermal stress and wind loads.
 - 4. Glass heat-treated by horizontal (roller hearth) process with inherent roller wave distortion parallel to the bottom edge of the glass as installed when specified.

2.4 OBSCURE GLASS (GL-3)

A. Sealed Edge Units (SEU) Installed in Wood Windows.

1. Insulating Glass Unit Makeup

a. Outboard Lite:

- 1) Basis-of-Design: Cardinal IG, Low E2 -272 (#2 Clear), or approved equal.
- 2) Glass Type: Class 1 (clear).
- 3) Glass Tint: Clear.
- 4) Nominal Thickness: 3.0/3.1 mm (1/8 inch).
- 5) Glass Strength: Heat strengthened. Provide tempered where required.
- 6) Coating orientation: Surface #2.

b. Spacer:

- 1) Nominal thickness: 13.00 mm (1/2 inch).
- 2) Gas Fill: 90% Argon.

c. Inboard Lite

- 1) Glass Type: Class 1 (clear).
- 2) Glass Tint: Marvin Specialty Glass: Sandblasted (SC-75).
- 3) Nominal Thickness: 3.0/3.1 mm (1/8 inch).
- 4) Glass strength: Heat strengthened. Provide tempered where required.

2. Performance Characteristics (Center of Glass):

- a. Visible Transmittance: 72%.
- b. Visible Exterior Reflectance: 11%.
- c. Visible Exterior Reflectance: 12%.
- d. U-factor (U-value): 0.25.
- e. Shading Coefficient (SC): 0.47.

- f. Solar Heat Gain Coefficient (SHGC): 0.41.
- 3. Glass shall be heat strengthened or tempered as required by codes, or as required to meet thermal stress and wind loads.
- 4. Glass heat-treated by horizontal (roller hearth) process with inherent roller wave distortion parallel to the bottom edge of the glass as installed when specified.

2.5 ECO RESIN PANEL (GL-4)

- A. Basis-of-Design: 3-Form, Varia Ecoresin™ Organic Panels in "Bear Grass Lite" Pattern.
- B. Panels
 - 1. Engineered Polyester Resin.
 - 2. Thickness: 6 mm (1/4 inch) as indicated.
 - 3. Sheet size 4' x 10'
 - 4. Finish: Patina - Front and Back
- C. Interlayer Materials: Compatible with polyester and bonding process to create a monolithic sheet of material when complete.
- D. Characteristics:
 - 1. Rate of Burning: CCl Rating for a nominal thickness of 1.5 mm (0.060 inches) and greater.
 - 2. Self-Ignition Temperature: Greater than 650° F.
 - 3. Smoke Density: Less than 75%
 - 4. Flame Spread: Less than 25.
 - 5. Smoke Developed: Less than 450.
 - 6. Safety Glazing: Must attain a class A impact rating in accordance with ANSI Z97.1-2004 at 1/8" thickness.
- E. Comply with manufacturer's written recommendations for fabrication and installation.
- F. Install panels so that they "hang" from the top edge. Do not rest on bottom rail.

2.5 ECO RESIN PANEL (GL-5)

- A. Basis-of-Design: 3-Form, Varia Ecoresin™ Organic Panels in "Bear Grass Lite" Pattern.
- B. Panels
 - 1. Engineered Polyester Resin.
 - 2. Thickness: 3 mm (1/8 inch) as indicated.
 - 3. Sheet size 4' x 10'
 - 4. Finish: Patent - front and back

- C. Interlayer Materials: Compatible with polyester and bonding process to create a monolithic sheet of material when complete.
- D. Characteristics:
 - 1. Rate of Burning: CCl Rating for a nominal thickness of 1.5 mm (0.060 inches) and greater.
 - 2. Self-Ignition Temperature: Greater than 650° F.
 - 3. Smoke Density: Less than 75%
 - 4. Flame Spread: Less than 25.
 - 5. Smoke Developed: Less than 450.
 - 6. Safety Glazing: Must attain a class A impact rating in accordance with ANSI Z97.1-2004 at 1/8" thickness.
- E. Comply with manufacturer's written recommendations for fabrication and installation.

2.6 FIRE RESISTANT GLASS WITHOUT WIRE MESH

- A. Fire resistant glass or glass assembly classified by UL in Building Materials Directory or other approved testing laboratory bearing permanent mark of classification.
- B. Firelite.
 - 1. UL listing R13377-1, 4.8 mm (3/16 inch) thick, unpolished.
 - 2. Distributed by Technical Glass Products; Kirkland, WA 98033.
- C. Pyrovue Commercial.
 - 1. UL listing R10178(N), 41 mm (1-5/8 inch) thick.
 - 2. Represented by Advanced Glass Systems Corporation, Trumbauersville, PA 18970-0051

2.7 GLAZING ACCESSORIES

- A. As required to supplement the accessories provided with the items to be glazed and to provide a complete installation. Ferrous metal accessories exposed in the finished work shall have a finish that will not corrode or stain while in service.
- B. Setting Blocks: ASTM C864:
 - 1. Channel shape; having 6 mm (1/4 inch) internal depth.
 - 2. Shore a hardness of 80 to 90 Durometer.
 - 3. Block lengths: 50 mm (two inches) except 100 to 150 mm (four to six inches) for insulating glass.
 - 4. Block width: Approximately 1.6 mm (1/16 inch) less than the full width of the rabbet.

5. Block thickness: Minimum 4.8 mm (3/16 inch). Thickness sized for rabbet depth as required.
- C. Spacers: ASTM C864:
1. Channel shape having a 6 mm (1/4 inch) internal depth.
 2. Flanges not less 2.4 mm (3/32 inch) thick and web 3 mm (1/8 inch) thick.
 3. Lengths: One to 25 to 76 mm (one to three inches).
 4. Shore a hardness of 40 to 50 Durometer.
- D. Sealing Tapes:
1. Semi-solid polymeric based material exhibiting pressure-sensitive adhesion and withstanding exposure to sunlight, moisture, heat, cold, and aging.
 2. Shape, size and degree of softness and strength suitable for use in glazing application to prevent water infiltration.
- E. Spring Steel Spacer: Galvanized steel wire or strip designed to position glazing in channel or rabbeted sash with stops.
- F. Glazing Gaskets: ASTM C864:
1. Firm dense wedge shape for locking in sash.
 2. Soft, closed cell with locking key for sash key.
 3. Flanges may terminate above the glazing-beads or terminate flush with top of beads.
- G. Lock-Strip Glazing Gaskets: ASTM C542, shape, size, and mounting as indicated.
- H. Glazing Sealants: ASTM C920, silicone neutral cure:
1. Type S.
 2. Class 25
 3. Grade NS.
 4. Shore A hardness of 25 to 30 Durometer.
- I. Color:
1. Color of glazing compounds, gaskets, and sealants used for aluminum color frames shall match color of the finished aluminum and be nonstaining.
 2. Color of other glazing compounds, gaskets, and sealants which will be exposed in the finished work and unpainted shall be black, gray, or neutral color.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verification of Conditions:

1. Examine openings for glass and glazing units; determine they are proper size; plumb; square; and level before installation is started.
 2. Verify that glazing openings conform with details, dimensions and tolerances indicated on manufacturer's approved shop drawings.
- B. Advise Contractor of conditions which may adversely affect glass and glazing unit installation, prior to commencement of installation: Do not proceed with installation until unsatisfactory conditions have been corrected.
- C. Verify that wash down of adjacent masonry is completed prior to erection of glass and glazing units to prevent damage to glass and glazing units by cleaning materials.

3.2 PREPARATION

- A. For sealant glazing, prepare glazing surfaces in accordance with GANA-02 Sealant Manual.
- B. Determine glazing unit size and edge clearances by measuring the actual unit to receive the glazing.
- C. Shop fabricate and cut glass with smooth, straight edges of full size required by openings to provide GANA recommended edge clearances.
- D. Verify that components used are compatible.
- E. Clean and dry glazing surfaces.
- F. Prime surfaces scheduled to receive sealants, as determined by preconstruction sealant-substrate testing.

3.3 INSTALLATION - GENERAL

- A. Install in accordance with GANA-01 Glazing Manual and GANA-02 Sealant Manual unless specified otherwise.
- B. Glaze in accordance with recommendations of glazing and framing manufacturers, and as required to meet the Performance Test Requirements specified in other applicable sections of specifications.
- C. Set glazing without bending, twisting, or forcing of units.
- D. Do not allow glass to rest on or contact any framing member.
- E. Glaze doors and operable sash, in a securely fixed or closed and locked position, until sealant, glazing compound, or putty has thoroughly set.
- F. Tempered Glass: Install with roller distortions in horizontal position unless otherwise directed.
- G. Insulating Glass Units:
 1. Glaze in compliance with glass manufacturer's written instructions.

2. When glazing gaskets are used, they shall be of sufficient size and depth to cover glass seal or metal channel frame completely.
3. Do not use putty or glazing compounds.
4. Do not grind, nip, cut, or otherwise alter edges and corners of fused glass units after shipping from factory.
5. Install with tape or gunnable sealant in wood sash.

H. Fire Resistant Glass:

1. Other fire resistant glass: Glaze in accordance with UL design requirements.

3.4 INSTALLATION - DRY METHOD (TAPE AND GASKET GLAZING)

- A. Cut glazing tape to length; install on glazing pane. Seal corners by butting and sealing junctions with butyl sealant.
- B. Place setting blocks at 1/3 points with edge block no more than 150 mm (6 inches) from corners.
- C. Rest glazing on setting blocks and push against fixed stop with sufficient pressure to attain full contact.
- D. Install removable stops without displacing glazing spline. Exert pressure for full continuous contact.
- E. Do not exceed edge pressures stipulated by glass manufacturers for installing glass lites.
- F. Trim protruding tape edge.

3.5 INSTALLATION - WET/DRY METHOD (PREFORMED TAPE AND SEALANT)

- A. Cut glazing tape to length and set against permanent stops, 5 mm (3/16 inch) below sight line. Seal corners by butting tape and dabbing with butyl sealant.
- B. Apply heel bead of butyl sealant along intersection of permanent stop with frame ensuring full perimeter seal between glass and frame to complete the continuity of the air and vapor seal.
- C. Place setting blocks at 1/3 points with edge block no more than 150 mm (6 inches) from corners.
- D. Rest glazing on setting blocks and push against tape and heel bead of sealant with sufficient pressure to achieve full contact at perimeter of pane or glass unit.
- E. Install removable stops, with spacer strips inserted between glazing and applied stops, 6 mm (1/4 inch) below sight line. Place glazing tape on glazing pane or unit with tape flush with sight line.

- F. Fill gap between glazing and stop with sealant to depth equal to bite of frame on glazing, but not more than 9 mm (3/8 inch) below sight line.
- G. Apply cap bead of sealant along void between the stop and the glazing, to uniform line, flush with sight line. Tool or wipe sealant surface smooth.

3.6 INSTALLATION - WET METHOD (SEALANT AND SEALANT)

- A. Place setting blocks at 1/3 points and install glazing pane or unit.
- B. Install removable stops with glazing centered in space by inserting spacer shims both sides at 600 mm (24 inch) intervals, 6 mm (1/4 inch) below sight line.
- C. Fill gaps between glazing and stops with sealant to depth of bite on glazing, but not more than 9 mm (3/8 inch) below sight line to ensure full contact with glazing and continue the air and vapor seal.
- D. Apply sealant to uniform line, flush with sight line. Tool or wipe sealant surface smooth.

3.7 INSTALLATION - INTERIOR WET/DRY METHOD (TAPE AND SEALANT)

- A. Cut glazing tape to length and install against permanent stops, projecting 1.6 mm (1/16 inch) above sight line.
- B. Place setting blocks at 1/3 points with edge block no more than 150 mm (6 inches) from corners.
- C. Rest glazing on setting blocks and push against tape to ensure full contact at perimeter of pane or unit.
- D. Install removable stops, spacer shims inserted between glazing and applied stops at 600 mm (24 inch) intervals, 6 mm (1/4 inch) below sight line.
- E. Fill gaps between pane and applied stop with sealant to depth equal to bite on glazing, to uniform and level line.
- F. Trim protruding tape edge.

3.8 REPLACEMENT AND CLEANING

- A. Clean new glass surfaces removing temporary labels, paint spots, and defacement after approval by COTR.
- B. Replace cracked, broken, and imperfect glass, or glass which has been installed improperly.
- C. Leave glass, putty, and other setting material in clean, whole, and acceptable condition.
- D. Clean glass per manufacturer's recommendations.

3.9 PROTECTION

Protect finished surfaces from damage during erection, and after completion of work. Strippable plastic coatings on colored anodized finish are not acceptable.

3.10 GLAZING SCHEDULE

A. Fire Resistant Glass:

1. Use Fire Resistant Glass without wire mesh in the following:
 - a. Interior and exterior fire rated or labeled doors and windows.

B. Tempered Glass:

1. Install in full and half glazed doors unless indicated otherwise.
2. Install in storefront, windows, and door sidelights adjacent to doors.
3. Use clear tempered glass on interior side lights and doors.
4. Use SEU Low E tempered and clear glass, G-41, on storefront and sidelights.

C. Clear Glass:

1. Interior windows not specified otherwise.
2. Interior pane of dual glazed windows not receiving tempered, or ceramic coated glass, or other special glass indicated or specified.

D. Insulating Glass:

1. Install SEU clear tempered glass in windows, interior pane of dual glazed windows, storefronts, curtain walls, adjacent to entrances or walks.
2. Install SEU clear glass in windows, interior pane of dual glazed windows, storefronts, curtain walls, not adjacent to entrances or walks.

- - - E N D - - -

SECTION 08 90 00 LOUVERS
AND VENTS

PART 1 - GENERAL

1.1 DESCRIPTION

This section specifies fixed architectural wall louvers.

1.2 RELATED WORK

- A. Roofing: Section 07 54 23 THERMOPLASTIC POLYOLEFIN (TPO) ROOFING.
- B. Division 23: HEATING, VENTILATING, AND AIR CONDITIONING (HVAC).
- C. Specification Sections for additional

louvers. **1.3 SUBMITTALS**

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Cut Sheets: Proposed Louver and Finish.
- C. Manufacturer's Literature and Data:
Each type of louver and vent.

1.4 APPLICABLE PUBLICATIONS

- A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.
- B. The Master Painters Institute (MPI):
Approved Product List - November 2007
- C. American Society for Testing and Materials (ASTM):
A167-99(R2004) Stainless and Heat-Resisting Chromium - Nickel
Steel Plate, Sheet, and Strip
A1008/A1008M REV A-07 . Steel, Sheet, Carbon, Cold Rolled, Structural, and
High Strength Low-Alloy with Improved Formability
B209/B209M-07 Aluminum and Aluminum Alloy, Sheet and Plate
B221-06 Aluminum and Aluminum Alloy Extruded Bars, Rods,
Wire, Shapes, and Tubes
B221M-07 Aluminum and Aluminum Alloy Extruded Bars, Rods,
Wire Shapes, and Tubes
- D. National Association of Architectural Metal Manufacturers (NAAMM):
AMP 500-505 (1988) Metal Finishes Manual
- E. National Fire Protection Association (NFPA):
90A-02 Installation of Air Conditioning and Ventilating
Systems
- G. American Architectural Manufacturers Association (AAMA):
605-98 High Performance Organic Coatings on
Architectural Extrusions and Panels

- H. Air Movement and Control Association, Inc. (AMCA):
500-L-99 Testing Louvers

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Aluminum, Extruded: ASTM B221/B221M.
- B. Stainless Steel: ASTM A167, Type 302B.
- C. Carbon Steel: ASTM A1008/A1008M.
- D. Aluminum, Plate and Sheet: ASTM B209/B209M.
- E. Fasteners: Fasteners for securing louvers and wall vents to adjoining construction, except as otherwise specified or shown, shall be toggle or expansion bolts, of size and type as required for each specific type of installation and service condition.
 - 1. Where type, size, or spacing of fasteners is not shown or specified, submit shop drawings showing proposed fasteners, and method of installation.
 - 2. Fasteners for louvers, louver frames, and wire guards shall be of stainless steel or aluminum.

2.2 EXTERIOR ARCHITECTURAL WALL LOUVERS

- A. General:
 - 1. Provide fixed type louvers in TPO Roof on back side of Mansard Roof. Louvers shall be 12" x 18" in locations indicated on Drawings.
 - 2. Heads, sills and jamb sections shall have formed caulking slots or be designed to retain caulking. Head sections shall have exterior drip lip, and sill sections an integral water stop.
 - 3. Frame shall be mechanically fastened or welded construction with welds dressed smooth and flush.

2.3 FINISH

- A. In accordance with NAAMM Metal Finishes Manual: AMP 500-505
- B. Sheet Steel: Baked-on shop prime coat on all surfaces.
 - 1. Provide a white powder coat finish on all exposed

2.11 PROTECTION

- A. Provide protection for aluminum against galvanic action wherever dissimilar materials are in contact, by painting the contact surfaces of the dissimilar material with a heavy coat of bituminous paint (complete coverage), or by separating the contact surfaces with a performed synthetic rubber tape having pressure sensitive adhesive coating on one side.
- B. Protect finished surfaces from damage during fabrication, erection, and after completion of the work.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Set work accurately, in alignment and where shown. Items shall be plumb, level, free of rack and twist, and set parallel or perpendicular as required to line and plane of surface.
- B. Furnish setting drawings and instructions for installation of anchors and for the positioning of items having anchors to be built into masonry construction. Provide temporary bracing for such items until masonry is set.
- C. Provide anchoring devices and fasteners as shown and as necessary for securing louvers to building construction where specified. Power actuated drive pins may be used, except for removal items and where members would be deformed or substrate damaged by their use.
- D. Generally, set wall louvers in walls during progress of the work. If wall louvers are not delivered to job in time for installation in prepared openings, make provision for later installation, and protect opening against elements.
- E. Seal around louvers with sealant approved by roof membrane manufacturer.

3.2 CLEANING AND ADJUSTING

- A. After installation, all exposed prefinished and plated items and all items fabricated from stainless steel and aluminum shall be cleaned as recommended by the manufacturer and protected from damage until completion of the project.
- B. All movable parts, including hardware, shall be cleaned and adjusted to operate as designed without binding or deformation of the members, so as to be centered in the opening of frame, and where applicable, to have all contact surfaces fit tight and even without forcing or warping the components

- - - E N D - - -

THIS PAGE INTENTIONALLY LEFT BLANK

SECTION 09 22 16
NON-STRUCTURAL METAL FRAMING

PART 1 - GENERAL

1.1 DESCRIPTION

This section specifies steel studs wall systems, shaft wall systems, ceiling or soffit suspended or furred framing, wall furring, fasteners, and accessories for the screw attachment of gypsum board, plaster bases or other building boards.

1.2 RELATED WORK

- A. Load bearing framing: Section 05 40 00, COLD-FORMED METAL FRAMING.
- B. Support for wall mounted items: Section 05 50 00, METAL FABRICATIONS.
- C. Pull down tabs in steel decking: Section 05 36 00, COMPOSITE METAL DECKING.
- D. Ceiling suspension systems for acoustical tile or panels and lay in gypsum board panels: Section 09 51 00, ACOUSTICAL CEILINGS Section 09 29 00, GYPSUM BOARD.

1.3 TERMINOLOGY

- A. Description of terms shall be in accordance with ASTM C754, ASTM C11, ASTM C841 and as specified.
- B. Underside of Structure Overhead: In spaces where steel trusses or bar joists are shown, the underside of structure overhead shall be the underside of the floor or roof construction supported by beams, trusses, or bar joists. In interstitial spaces with walk-on floors the underside of the walk-on floor is the underside of structure overhead.
- C. Thickness of steel specified is the minimum bare (uncoated) steel thickness.

1.4 SUBMITTALS

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Manufacturer's Literature and Data:
 - 1. Studs, runners and accessories.
 - 2. Hanger inserts.
 - 3. Channels (Rolled steel).
 - 4. Furring channels.
 - 5. Screws, clips and other fasteners.
- C. Test Results: Fire rating test designation, each fire rating required for each assembly.

1.5 DELIVERY, IDENTIFICATION, HANDLING AND STORAGE

In accordance with the requirements of ASTM

C754. 1.6 APPLICABLE PUBLICATIONS

- A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.
- B. American Society For Testing And Materials (ASTM)
- | | | |
|----------------|-------|--|
| A123-09 | ..... | Zinc (Hot-dip Galvanized) Coatings on Iron and Steel Products |
| A653/A653M-09 | ..... | Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy Coated (Galvannealed) by the Hot-Dip Process |
| A641-09 | ..... | Zinc-Coated (Galvanized) Carbon Steel Wire |
| C11-10 | ..... | Terminology Relating to Gypsum and Related Building Materials and Systems |
| C635-07 | ..... | Manufacture, Performance, and Testing of Metal Suspension System for Acoustical Tile and Lay-in Panel Ceilings |
| C636-06 | ..... | Installation of Metal Ceiling Suspension Systems for Acoustical Tile and Lay-in Panels |
| C645-09 | ..... | Non-Structural Steel Framing Members |
| C754-09 | ..... | Installation of Steel Framing Members to Receive Screw-Attached Gypsum Panel Products |
| C841-03(R2008) | ..... | Installation of Interior Lathing and Furring |
| C954-07 | ..... | Steel Drill Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Steel Studs from 0.033 in. (0.84 mm) to 0.112 in. (2.84 mm) in Thickness |
| C1002-07 | ..... | Steel Self-Piercing Tapping Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Wood Studs or Steel Studs |
| E580-09 | ..... | Application of Ceiling Suspension Systems for Acoustical Tile and Lay-in Panels in Areas Requiring Moderate Seismic Restraint. |

PART 2 - PRODUCTS

2.1 PROTECTIVE COATING

Galvanize steel studs, runners (track), rigid (hat section) furring channels, "Z" shaped furring channels, and resilient furring channels, with coating designation of G-60 minimum, per ASTM 123.

2.2 STEEL STUDS AND RUNNERS (TRACK)

- A. ASTM C645, modified for thickness specified and sizes as shown.
 - 1. Use ASTM A525 steel, 0.8 mm (0.0329-inch) thick bare metal (33 mil).
 - 2. Runners same thickness as studs.
- B. Provide not less than two cutouts in web of each stud, approximately 300 mm (12 inches) from each end, and intermediate cutouts on approximately 600 mm (24-inch) centers.
- C. Doubled studs for openings and studs for supporting concrete backer-board.
- D. Studs 3600 mm (12 feet) or less in length shall be in one piece.
- E. Shaft Wall Framing:
 - 1. Conform to rated wall construction.
 - 2. C-H Studs.
 - 3. E Studs.
 - 4. J Runners.
 - 5. Steel Jamb-Strut.

2.3 FURRING CHANNELS

- A. Rigid furring channels (hat shape): ASTM C645.
- B. Resilient furring channels:
 - 1. Not less than 0.45 mm (0.0179-inch) thick bare metal.
 - 2. Semi-hat shape, only one flange for anchorage with channel web leg slotted on anchorage side, channel web leg on other side stiffens fastener surface but shall not contact anchorage surface other channel leg is attached to.
- C. "Z" Furring Channels:
 - 1. Not less than 0.45 mm (0.0179-inch)-thick bare metal, with 32 mm (1-1/4 inch) and 19 mm (3/4-inch) flanges.
 - 2. Web furring depth to suit thickness of insulation with slotted perforations.
- D. Rolled Steel Channels: ASTM C754, cold rolled; or, ASTM C841, cold rolled.

2.4 FASTENERS, CLIPS, AND OTHER METAL ACCESSORIES

- A. ASTM C754, except as otherwise specified.
- B. For fire rated construction: Type and size same as used in fire rating test.
- C. Fasteners for steel studs thicker than 0.84 mm (0.033-inch) thick. Use ASTM C954 steel drill screws of size and type recommended by the manufacturer of the material being fastened.

- D. Clips: ASTM C841 (paragraph 6.11), manufacturer's standard items. Clips used in lieu of tie wire shall have holding power equivalent to that provided by the tie wire for the specific application.
- E. Concrete ceiling hanger inserts (anchorage for hanger wire and hanger straps): Steel, zinc-coated (galvanized), manufacturers standard items, designed to support twice the hanger loads imposed and the type of hanger used.
- F. Tie Wire and Hanger Wire:
 - 1. ASTM A641, soft temper, Class 1 coating.
 - 2. Gage (diameter) as specified in ASTM C754 or ASTM C841.
- G. Attachments for Wall Furring:
 - 1. Manufacturers standard items fabricated from zinc-coated (galvanized) steel sheet.
 - 2. For concrete or masonry walls: Metal slots with adjustable inserts or adjustable wall furring brackets. Spacers may be fabricated from 1 mm (0.0396-inch) thick galvanized steel with corrugated edges.
- H. Power Actuated Fasteners: Type and size as recommended by the manufacturer of the material being fastened.

2.5 SUSPENDED CEILING SYSTEM FOR GYPSUM BOARD (OPTION)

- A. Conform to ASTM C635, heavy duty, with not less than 35 mm (1-3/8 inch) wide knurled capped flange face designed for screw attachment of gypsum board.
- B. Wall track channel with 35 mm (1-3/8 inch) wide flange. PART 3 - EXECUTION

3.1 INSTALLATION CRITERIA

- A. Where fire rated construction is required for walls, partitions, columns, beams and floor-ceiling assemblies, the construction shall be same as that used in fire rating test.
- B. Construction requirements for fire rated assemblies and materials shall be as shown and specified, the provisions of the Scope paragraph (1.2) of ASTM C754 and ASTM C841 regarding details of construction shall not apply.

3.2 INSTALLING STUDS

- A. Install studs in accordance with ASTM C754, except as otherwise shown or specified.
- B. Maximum stud spacing shall be 400 mm (16 inches) on center.
- C. Cut studs 6 mm to 9 mm (1/4 to 3/8-inch) less than floor to underside of structure overhead when extended to underside of structure overhead.

- D. Where studs are shown to terminate above suspended ceilings, provide bracing as shown or extend studs to underside of structure overhead.
- E. Extend studs to underside of structure overhead for fire, rated partitions, smoke partitions, shafts, and sound rated partitions.

F. Openings:

1. Frame jambs of openings in stud partitions and furring with two studs placed back to back or as shown.
2. Fasten back to back studs together with 9 mm (3/8-inch) long Type S pan head screws at not less than 600 mm (two feet) on center, staggered along webs.
3. Studs fastened flange to flange shall have splice plates on both sides approximately 50 X 75 mm (2 by 3 inches) screwed to each stud with two screws in each stud. Locate splice plates at 600 mm (24 inches) on center between runner tracks.

G. Fastening Studs:

1. Fasten studs located adjacent to partition intersections, corners and studs at jambs of openings to flange of runner tracks with two screws through each end of each stud and flange of runner.
2. Do not fasten studs to top runner track when studs extend to underside of structure overhead.

H. Chase Wall Partitions:

1. Locate cross braces for chase wall partitions to permit the installation of pipes, conduits, carriers and similar items.
2. Use studs or runners as cross bracing not less than 63 mm (2-1/2 inches wide).

I. Form control joint, with double studs spaced 13 mm (1/2-inch)

apart. **3.3 INSTALLING WALL FURRING FOR FINISH APPLIED TO ONE SIDE ONLY**

- A. In accordance with ASTM C754, or ASTM C841 except as otherwise specified or shown.

B. Wall furring-Stud System:

1. Framed with 63 mm (2-1/2 inch) or narrower studs, 400 mm (16 inches) on center.
2. Brace as specified in ASTM C754 for Wall Furring-Stud System or brace with sections or runners or studs placed horizontally at not less than three foot vertical intervals on side without finish.
3. Securely fasten braces to each stud with two Type S pan head screws at each bearing.

C. Direct attachment to masonry or concrete; rigid channels or "Z" channels:

1. Install rigid (hat section) furring channels at 400 mm (16 inches) on center, horizontally or vertically.
2. Install "Z" furring channels vertically spaced not more than 600 mm (24 inches) on center.

3. At corners where rigid furring channels are positioned horizontally, provide mitered joints in furring channels.
 4. Ends of spliced furring channels shall be nested not less than 200 mm (8 inches).
 5. Fasten furring channels to walls with power-actuated drive pins or hardened steel concrete nails. Where channels are spliced, provide two fasteners in each flange.
 6. Locate furring channels at interior and exterior corners in accordance with wall finish material manufacturers printed erection instructions. Locate "Z" channels within 100 mm (4 inches) of corner.
- D. Installing Wall Furring-Bracket System: Space furring channels not more than 400 mm (16 inches) on center.

3.4 INSTALLING SUPPORTS REQUIRED BY OTHER TRADES

- A. Provide for attachment and support of electrical outlets, plumbing, laboratory or heating fixtures, recessed type plumbing fixture accessories, access panel frames, wall bumpers, wood seats, toilet stall partitions, dressing booth partitions, urinal screens, chalkboards, tackboards, wall-hung casework, handrail brackets, recessed fire extinguisher cabinets and other items like auto door buttons and auto door operators supported by stud construction.
- B. Provide additional studs where required. Install metal backing plates, or special metal shapes as required, securely fastened to metal studs.

3.5 INSTALLING SHAFT WALL SYSTEM

- A. Provide one hour fire rating Shaft wall where indicated on Drawings.
- B. Position J runners at floor and ceiling with the short leg toward finish side of wall. Securely attach runners to structural supports with power driven fasteners at both ends and 400 mm (16 inches) on center.
- C. After liner panels have been erected, cut C-H studs and E studs, from 9 mm (3/8-inch) to not more than 13 mm (1/2-inch) less than floor-to-ceiling height. Install C-H studs between liner panels with liner panels inserted in the groove.
- D. Install full-length steel E studs over shaft wall line at intersections, corners, hinged door jambs, columns, and both sides of closure panels.
- E. Suitably frame all openings to maintain structural support for wall:
 1. Provide necessary liner fillers and shims to conform to label frame requirements.
 2. Frame openings cut within a liner panel with E studs around perimeter.

3. Frame openings with vertical E studs at jambs, horizontal J runner at head and sill.

F. Elevator Shafts:

1. Frame elevator door frames with 0.87 mm (0.0341-inch) thick J strut or J stud jambs having 75 mm (three-inch) long legs on the shaft side.
2. Protrusions including fasteners other than flange of shaft wall framing system or offsets from vertical alignments more than 3 mm (1/8-inch) are not permitted unless shown.
3. Align shaft walls for plumb vertical flush alignment from top to bottom of shaft.

3.6 INSTALLING FURRED AND SUSPENDED CEILINGS OR SOFFITS

A. Install furred and suspended ceilings or soffits in accordance with ASTM C754 or ASTM C841 except as otherwise specified or shown for screw attached gypsum board ceilings and for plaster ceilings or soffits.

1. Space framing at 400 mm (16-inch) centers for metal lath anchorage.
2. Space framing at 400 mm (16-inch) centers for gypsum board anchorage.

B. New exposed concrete slabs:

1. Use metal inserts required for attachment and support of hangers or hanger wires with tied wire loops for embedding in concrete.
2. Furnish for installation under Division 3, CONCRETE.
3. Suspended ceilings under concrete rib construction shall have runner channels at right angles to ribs and be supported from ribs with hangers at ends and at 1200 mm (48-inch) maximum intervals along channels. Stagger hangers at alternate channels.

C. Concrete slabs on steel decking composite construction:

1. Use pull down tabs when available.
2. Use power activated fasteners when direct attachment to structural framing can not be accomplished.

D. Where bar joists or beams are more than 1200 mm (48 inches) apart, provide intermediate hangers so that spacing between supports does not exceed 1200 mm (48 inches). Use clips, bolts, or wire ties for direct attachment to steel framing.

E. Steel decking without concrete topping:

1. Do not fasten to steel decking 0.76 mm (0.0299-inch) or thinner.
2. Toggle bolt to decking 0.9 mm (0.0359-inch) or thicker only where anchorage to steel framing is not possible.

F. Installing suspended ceiling system for gypsum board (ASTM C635 Option):

1. Install only for ceilings to receive screw attached gypsum board.
2. Install in accordance with ASTM C636.
 - a. Install main runners spaced 1200 mm (48 inches) on center.

b. Install 1200 mm (four foot) tees not over 600 mm (24 inches) on center; locate for edge support of gypsum board.

c. Install wall track channel at perimeter.

G. Installing Ceiling Bracing System:

1. Construct bracing of 38 mm (1-1/2 inch) channels for lengths up to 2400 mm (8 feet) and 50 mm (2 inch) channels for lengths over 2400 mm (8 feet) with ends bent to form surfaces for anchorage to carrying channels and over head construction. Lap channels not less than 600 mm (2 feet) at midpoint back to back. Screw or bolt lap together with two fasteners.
2. Install bracing at an approximate 45 degree angle to carrying channels and structure overhead; secure as specified to structure overhead with two fasteners and to carrying channels with two fasteners or wire ties.
3. Brace suspended ceiling or soffit framing in seismic areas in accordance with ASTM E580.

3.7 TOLERANCES

- A. Fastening surface for application of subsequent materials shall not vary more than 3 mm (1/8-inch) from the layout line.
- B. Plumb and align vertical members within 3 mm (1/8-inch.)
- C. Level or align ceilings within 3 mm (1/8-inch.)

- - - E N D - - -

SECTION 09 24 00
PORTLAND CEMENT PLASTERING

PART 1 GENERAL

1.1 DESCRIPTION

This section specifies lathing and Portland cement based plaster (stucco).

1.2 RELATED WORK

- A. Steel framing members for attachment of plaster bases: Section 05 40 00, COLD-FORMED METAL FRAMING, and Section 09 22 16, NON-STRUCTURAL METAL FRAMING.

1.3 TERMINOLOGY

- A. Definitions and description of terms shall be in accordance with ASTM C11, C841, and C926 and as specified.
- B. Underside of Structure Overhead: In spaces where steel trusses or bar joists are shown, the underside of structure overhead shall be the underside of the floor or roof construction supported by beams, trusses, and bar joists.
- C. Self-furring Lath: Metal plastering bases having dimples or crimps designed to hold the plane of the back of the lath 6 to 10 mm (1/4 to 3/8 inch) away from the plane of the solid backing.
- D. Solid Backing or Solid Bases: Concrete, masonry, sheathing, rigid insulation, and similar materials to which plaster is directly applied.
- E. Wet Areas: Areas of a building where cyclic or continuous exposure to very humid or wet conditions, or in which a dew point condition may occur in the plaster. Dew point conditions occur frequently in such areas as laundries, natatoriums, cart and dish washing spaces, hydrotherapy, kitchens, bathing or shower rooms and similar areas.

1.4 SUBMITTALS

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Manufacturer's Literature and Data:
1. Accessories for plaster, each type.
 2. Metal plastering bases, each type.
 3. Fasteners.
 4. Bonding compounds, including application instructions.
 5. Admixtures, including mixing and application instructions.
- C. Samples:
1. Panel showing finish coat 150 mm by 300 mm (6 x 12 inches).

1.5 PROJECT CONDITIONS

- A. Maintain work areas for interior work at a temperature of not less than 4°C (40°F) for not less than 48 hours prior to application of plaster, during application of plaster and until plaster is completely dry.
- B. Exterior plaster shall not be applied when the ambient temperature is less than 4°C (40°F).
- C. Plaster shall not be applied to frozen surfaces or surfaces containing frost.
- D. Frozen materials shall not be used in the mix.
- E. Plaster coats shall be protected against freezing for a period of not less than 24 hours after application.

1.6 APPLICABLE PUBLICATIONS

- A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by basic designation only.
- B. American Society for Testing And Materials (ASTM):
 - A653/A653M-07Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process
 - A641-03 Zinc-Coated (Galvanized) Carbon Steel Wire
 - C11-07Terminology Relating to Gypsum and Related Building Materials and Systems.
 - C91-05Masonry Cement
 - C150-07Portland Cement
 - C207-06Hydrated Lime for Masonry Purposes
 - C260-06Air Entraining Admixtures for Concrete.
 - C841-03 Installation of Interior Lathing and Furring
 - C847-06Metal Lath
 - C897-05Aggregate for Job-Mixed Portland Cement Based Plasters
 - C926-06Application of Portland Cement-Based Plaster
 - C933-07Welded Wire Lath
 - C979-05Pigments for Integrally Colored Concrete
 - C1002-07Steel Self-Piercing Tapping Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Wood Studs or Steel Studs
- C. Commercial Item Description (CID):
 - A-A-55615Shield, Expansion (Wood Screw and Lag Bolt Self-Threading Anchors)

D. Federal Specifications (Fed Spec.):

UU-B-790A Building Paper, Vegetable Fiber (Kraft,
Waterproofed, Water Repellent and Fire
Resistant)

PART 2 - PRODUCTS

2.1 METAL PLASTERING BASES

A. Expanded Metal Lath:

1. ASTM C847, zinc-coated (galvanized) except as modified by ASTM C841 and this specification. Self furring where applied over solid backing.
2. Flat diamond mesh weighing not less than 1.8 kg/m² (3.4 pounds per square yard).
3. Stucco Mesh: Flat expanded diamond mesh pattern, with openings approximately 38 by 75 mm (1-1/2 by 3 inches), weighing not less than 1.9 kg/ m² (3.6 pounds per square yard), with backing as specified.

B. Wire Lath:

1. Zinc coated (Galvanized).
2. Welded Wire Lath: ASTM C933, with backing as specified.
3. Self furring where applied over solid backing.

C. Building Paper Backing for Metal Plastering Bases:

1. Backing attached to lath as specified in ASTM C933.
2. Vapor Permeable Backing: Fed. Spec. UU-B-790, Type I, Grade D.
3. Water Resistant Backing: Fed. Spec. UU-B-790, Type I, Grade

B. 2.2 ACCESSORIES FOR CEMENT PLASTER (STUCCO)

A. ASTM C841, except fabricate from zinc alloy.

B. Control Joints: ASTM C841,

zinc. 2.3 FASTENERS

- A. Tie, wire, screws, clips, and other fasteners ASTM C841, except as otherwise specified.
- B. Fasteners for securing metal plastering bases shall have heads, or be through washers large enough to engage two strands of the metal plastering base.
- C. For fire rated construction; type and size as used in fire rated test.
- D. Screws: ASTM C1002.
- E. Expansion Shields: CID A-A-55615, of the Type and Class

applicable. 2.4 CEMENT

- A. Portland: ASTM C150, Type I.
- B. Masonry: ASTM C91. Lime where added, ASTM C207, Type S.
- C. White where required for white finish coat.

2.5 LIME

- A. ASTM C206, Type S.
- B. ASTM C207, Type S.

2.6 AGGREGATES (SAND)

- A. ASTM C897, graded as required to suit texture of finish specified.
- B. White where white finish coat is specified.

2.7 BONDING AGENT

ASTM C932.

2.8 FACTORY PREPARED FINISH COAT FOR CEMENT PLASTER (STUCCO)

- A. Factory prepared dry blend of materials, integrally colored, designed for exterior finish coat application.
- B. Pigments: ASTM C979, lime proof mineral oxide.
- C. Not more than 35 percent, by weight of all ingredients (cement, aggregate, hydrated lime, admixture and coloring pigment) shall pass a number 100 sieve.

2.9 ADMIXTURES

Air Entrainment: ASTM C260.

PART 3 - EXECUTION

3.1 METAL PLASTERING BASES (LATH) LOCATIONS

- A. On ceiling or soffit framing use flat diamond mesh lath.

3.2 APPLYING METAL PLASTERING BASES

- A. In accordance with ASTM C841, except as otherwise specified or shown.
- B. Form true surfaces, straight or in fair curves where shown, without sags or buckles and with long dimension of lath at right angles to direction of supports.
- C. Lath for ceiling or soffit construction shall terminate at casing bead (floating angle construction) at perimeter angles between walls and ceilings or soffits.
- D. Lath with backing shall be applied to produce a paper to paper and metal to metal lap at ends and sides of adjacent sheets, whether full sheets or less than full sheets are used:
 - 1. Backing shall be lapped 50 mm (2 inches) for both horizontal and vertical laps.
 - 2. Horizontal laps shall be ship lap fashion to conduct water to the outside and over flashing or waterproofing.
- E. Metal plastering bases shall not be continuous through expansion and control joints, but shall be stopped at each side.

3.3 INSTALLING PLASTERING ACCESSORIES

- A. Install accessories in accordance with ASTM C841, except as otherwise specified.
 - 1. Set plastering accessories plumb, level and true to line, neatly mitered at corners and intersections, and securely attach to supporting surfaces as specified for metal lath.
 - 2. Install in one piece, within the limits of the longest commercially available lengths.
- B. Corner Beads: Install at all vertical and horizontal external plaster corners, as required to establish grounds, and where shown.
- C. Strip Lath:
 - 1. Install metal lath strips centered over joints between dissimilar materials, such as hollow tile, brick, concrete masonry units, concrete, and joints with metal lath on framing or furring, where both such surfaces are required to be plastered and are in contact with each other in same plane, except where expansion joints and casing beads are required.
 - 2. Wire tie or fasten strip lath to base along both edges at not over 150 mm (six inches) on centers.
- D. Casing Beads:
 - 1. Install casing beads where shown and at following locations where plaster terminates to provide finish trim.
 - 2. Where plaster terminates against non-plastered surfaces such as masonry, concrete, and wood.
 - 3. Where plaster terminates against trim of steel frames and trim of other materials and equipment, except where trim overlaps plaster.
 - 4. Around perimeter of openings except where edge is covered by flanges. Locate to conform to dimensions shown on shop drawings.
 - 5. Where plaster for new walls or furring (vertical or horizontal) terminates against existing construction.
 - 6. Both sides of expansion and control joints unless shown otherwise.
 - 7. Install casing bead at perimeter angles between walls and ceilings so as to provide floating angle (unrestrained) construction in accordance with ASTM C841.
- E. Cornerites:
 - 1. Install at interior corners of walls, partitions, and other vertical surfaces to be plastered, except where metal lath is carried around angle.
 - 2. Fasten only as necessary to retain position during plastering.

3. Omit cornerites at junction of new plastered walls with existing plastered walls at locations where casing beads are specified. F.

Control Joints:

1. Where control joints are placed parallel to framing members, install joints within 100 mm (four inches) of the framing member.
2. Install control joints only to the edges of abutting sheets of lath so that the lath is not continuous or tied across the joint.
3. Joints shall extend the full width and height of the wall or length of soffit/ceiling plaster membrane.

3.4 SURFACE PREPARATION OF SOLID BASES

A. Surfaces that are to receive plaster shall be prepared and conditioned in accordance with ASTM C926, except as otherwise specified.

3.5 PORTLAND CEMENT BASED PLASTER

A. Provide portland cement based plaster where cement plaster (stucco) is shown and specified, and as follows:

1. Three coat work shall be used over all metal plastering bases, with or without solid backing.

B. Proportion, mix and apply plaster in accordance with ASTM C926, except as otherwise specified.

1. Use air entrained plaster for all exterior work.
2. Use coloring pigments for finish coat when integral color other than white is specified.
3. Use white cement with white sand when white finish coat is specified.
4. Factory prepared finish coat: Add water, mix, and apply as specified by manufacturer.
5. Color:
 - a. Color of finish coat shall be selected from manufacturer's full line of colors.
6. Finish coat shall be sand float texture.

- - - E N D - - -

SECTION 09 29 00
GYPSUM BOARD

PART 1 - GENERAL

1.1 DESCRIPTION

This section specifies installation and finishing of gypsum board.

1.2 RELATED WORK

- A. Installation of steel framing members for walls, partitions, furring, soffits, and ceilings: Section 05 40 00, COLD-FORMED METAL FRAMING, and Section 09 22 16, NON-STRUCTURAL METAL FRAMING.
- B. Acoustical Sealants: Section 07 92 00, JOINT SEALANTS.
- C. Installation of Ceramic/Porcelain Tile: Section 09 30

1.3 TERMINOLOGY

- A. Definitions and description of terms shall be in accordance with ASTM C11, C840, and as specified.
- B. Underside of Structure Overhead: In spaces where steel trusses or bar joists are shown, the underside of structure overhead shall be the underside of the floor or roof construction supported by the trusses or bar joists.
- C. "Yoked": Gypsum board cut out for opening with no joint at the opening (along door jamb or above the door).

1.4 SUBMITTALS

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Manufacturer's Literature and Data:
 - 1. Cornerbead and edge trim.
 - 2. Finishing materials.
 - 3. Laminating adhesive.
 - 4. Gypsum board, each type.
- C. Test Results:
 - 1. Fire rating test, each fire rating required for each assembly.
 - 2. Sound rating test.

1.5 DELIVERY, IDENTIFICATION, HANDLING AND STORAGE

In accordance with the requirements of ASTM C840.

1.6 ENVIRONMENTAL CONDITIONS

In accordance with the requirements of ASTM C840.

1.7 APPLICABLE PUBLICATIONS

- A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.

B. American Society for Testing And Materials (ASTM):

- C11-08 Terminology Relating to Gypsum and Related Building Materials and Systems
- C475-02 Joint Compound and Joint Tape for Finishing Gypsum Board
- C840-08 Application and Finishing of Gypsum Board
- C919-08 Sealants in Acoustical Applications
- C954-07 Steel Drill Screws for the Application of Gypsum Board or Metal Plaster Bases to Steel Stud from 0.033 in. (0.84mm) to 0.112 in. (2.84mm) in thickness
- C1002-07 Steel Self-Piercing Tapping Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Wood Studs or Steel Studs
- C1047-05 Accessories for Gypsum Wallboard and Gypsum Veneer Base
- C1177-06 Glass Mat Gypsum Substrate for Use as Sheathing
- C1658-06 Glass Mat Gypsum Panels
- C1396-06 Gypsum Board
- E84-08 Surface Burning Characteristics of Building Materials

C. Underwriters Laboratories Inc. (UL):

Latest Edition Fire Resistance Directory

D. Inchcape Testing Services (ITS):

Latest Editions Certification Listings

PART 2 - PRODUCTS**2.1 GYPSUM BOARD**

- A. Gypsum Board: ASTM C1396, Type X, 16 mm (5/8 inch) thick unless shown otherwise. Shall contain a minimum of 20 percent recycled gypsum.
- B. Coreboard or Shaft Wall Liner Panels.
1. ASTM C1396, Type X.
 2. ASTM C1658: Glass Mat Gypsum Panels,
 3. Coreboard for shaft walls 300, 400, 600 mm (12, 16, or 24 inches) wide by required lengths 25 mm (one inch) thick with paper faces treated to resist moisture.
- C. Water Resistant Gypsum Backing Board: ASTM C620, Type X, 16 mm (5/8 inch) thick.
- D. Gypsum cores shall contain a minimum of 95 percent post industrial recycled gypsum content. Paper facings shall contain 100 percent post-consumer recycled paper content.

2.2 GYPSUM SHEATHING BOARD

- A. ASTM E330, Type X, water-resistant core, Glass-Mat faced 16 mm (5/8 inch) thick.
- B. Dens-Glass Gold or approved equal.
- C. Sure-Board 200 Exterior Sheathing:
 - 1. 22 GA (0.027 inches) Galvanized Sheet Steel per ASTM A 653 CS laminated to Dens-Glass Gold.

2.3 ACCESSORIES

- A. ASTM C1047, except form of 0.39 mm (0.015 inch) thick zinc coated steel sheet or rigid PVC plastic.
- B. Flanges not less than 22 mm (7/8 inch) wide with punchouts or deformations as required to provide compound bond.

2.4 FASTENERS

- A. ASTM C1002 and ASTM C840, except as otherwise specified.
- B. ASTM C954, for steel studs thicker than 0.04 mm (0.33 inch).
- C. Select screws of size and type recommended by the manufacturer of the material being fastened.
- D. For fire rated construction, type and size same as used in fire rating test.
- E. Clips: Zinc-coated (galvanized) steel; gypsum board manufacturer's standard items.

2.5 FINISHING MATERIALS AND LAMINATING ADHESIVE

- A. ASTM C475 and ASTM C840. Free of antifreeze, vinyl adhesives, preservatives, biocides and other VOC. Adhesive shall contain a maximum VOC content of 50 g/l.

PART 3 - EXECUTION

3.1 GYPSUM BOARD HEIGHTS

- A. Extend all layers of gypsum board from floor to underside of structure overhead on following partitions and furring:
 - 1. Two sides of partitions:
 - a. Fire rated partitions.
 - b. Smoke partitions.
 - c. Sound rated partitions.
 - d. Full height partitions shown (FHP).
 - e. Corridor partitions.
 - 2. One side of partitions or furring:
 - a. Furring for pipes and duct shafts, except where fire rated shaft wall construction is shown.

3. Extend all layers of gypsum board construction used for fireproofing of columns from floor to underside of structure overhead, unless shown otherwise.

B. In locations other than those specified, extend gypsum board from floor to heights as follows:

1. Not less than 150 mm (6 inches) above suspended acoustical ceilings.
2. At ceiling of suspended gypsum board ceilings.
3. At existing ceilings.

3.2 INSTALLING GYPSUM BOARD

A. Coordinate installation of gypsum board with other trades and related work.

B. Install gypsum board in accordance with ASTM C840, except as otherwise specified.

C. Moisture and Mold-Resistant Assemblies: Provide and install moisture and mold-resistant glass mat gypsum wallboard products with moisture-resistant surfaces complying with ASTM C1658 where shown and in locations which might be subject to moisture exposure during construction.

1. Cementitious Backer Units at ceramic/porcelain tile locations.
2. Glass-Mat Liner Panels full height of wall, on all walls within rooms that contain moisture.

D. Use gypsum boards in maximum practical lengths to minimize number of end joints.

E. Bring gypsum board into contact, but do not force into place.

F. Ceilings:

1. Suspended where indicated on Drawings.
2. Suspend with 7/8" hat channels and 1 1/2" channels with wire hangers.

G. Walls (Except Shaft Walls):

1. When gypsum board is installed parallel to framing members, space fasteners 300 mm (12 inches) on center in field of the board, and 200 mm (8 inches) on center along edges.
2. When gypsum board is installed perpendicular to framing members, space fasteners 300 mm (12 inches) on center in field and along edges.
3. Stagger screws on abutting edges or ends.
4. For single-ply construction, apply gypsum board with long dimension either parallel or perpendicular to framing members as required to minimize number of joints except gypsum board shall be applied vertically over "Z" furring channels.

5. No offset in exposed face of walls and partitions will be permitted because of single-ply and two-ply or three-ply application requirements.
 6. Control Joints ASTM C840 and as follows:
 - a. Locate at both side jambs of openings if gypsum board is not "yoked". Use one system throughout.
 - b. Not required for wall lengths less than 9000 mm (30 feet).
 - c. Extend control joints the full height of the wall or length of soffit/ceiling membrane.
- H. Acoustical or Sound Rated Partitions, Fire and Smoke Partitions:
1. Cut gypsum board for a space approximately 3 mm to 6 mm (1/8 to 1/4 inch) wide around partition perimeter.
 2. Coordinate for application of caulking or sealants to space prior to taping and finishing.
 3. For sound rated partitions, use sealing compound (ASTM C919) to fill the annular spaces between all receptacle boxes and the partition finish material through which the boxes protrude to seal all holes and/or openings on the back and sides of the boxes. STC minimum values as shown.
- I. Electrical and Telecommunications Boxes:
1. Seal annular spaces between electrical and telecommunications receptacle boxes and gypsum board partitions.
- J. Accessories:
1. Set accessories plumb, level and true to line, neatly mitered at corners and intersections, and securely attach to supporting surfaces as specified.
 2. Install in one piece, without the limits of the longest commercially available lengths.
 3. Corner Beads:
 - a. Install at all vertical and horizontal external corners and where shown.
 - b. Use screws only. Do not use crimping tool.
 4. Edge Trim (casings Beads):
 - a. At both sides of expansion and control joints unless shown otherwise.
 - b. Where gypsum board terminates against dissimilar materials and at perimeter of openings, except where covered by flanges, casings or permanently built-in equipment.
 - c. Where gypsum board surfaces of non-load bearing assemblies abut load bearing members.
 - d. Where shown.

3.3 INSTALLING GYPSUM SHEATHING

- A. Install in accordance with ASTM C840, except as otherwise specified or shown.
- B. Use screws of sufficient length to secure sheathing to framing.
- C. Space screws 9 mm (3/8 inch) from ends and edges of sheathing and 200 mm (8 inches) on center. Space screws a maximum of 200 mm (8 inches) on center on intermediate framing members.
- D. Apply 600 mm by 2400 mm (2 foot by 8 foot) sheathing boards horizontally with tongue edge up.
- E. Apply 1200 mm by 2400 mm or 2700 mm (4 ft. by 8 ft. or 9 foot) gypsum sheathing boards vertically with edges over framing.
- F. Coordinate with structural documents for installation of sure-board structural panels.

3.4 CAVITY SHAFT WALL

- A. Coordinate assembly with Section 09 22 16, NON-STRUCTURAL METAL FRAMING, for erection of framing and gypsum board.
- B. Conform to UL Design No. U438 or FM WALL CONSTRUCTION 12-2/HR (Nonbearing for two-hour fire rating. Conform to FM WALL CONSTRUCTION 25-1/HR (Non-loadbearing) for one-hour fire rating where shown.
- C. Cut coreboard (liner) panels 25 mm (one inch) less than floor-to-ceiling height, and erect vertically between J-runners on shaft side.
 - 1. Where shaft walls exceed 4300 mm (14 feet) in height, position panel end joints within upper and lower third points of wall.
 - 2. Stagger joints top and bottom in adjacent panels.
 - 3. After erection of J-struts of opening frames, fasten panels to J-struts with screws of sufficient length to secure to framing staggered from those in base, spaced 300 mm (12 inches) on center.
- D. Gypsum Board:
 - 1. One hour wall with one layer on finish side of wall: Apply face layer of gypsum board vertically. Attach to studs with screws of sufficient length to secure to framing, spaced 300 mm (12 inches) on center in field and along edges.
 - 2. Where coreboard is covered with face layer of gypsum board, stagger joints of face layer from those in the coreboard base.
- E. Treat joints, corners, and fasteners in face layer as specified for finishing of gypsum board.

F. Elevator Shafts:

1. Protrusions including fasteners other than flange of shaft wall framing system or offsets from vertical alignments more than 3 mm (1/8-inch) are not permitted unless shown.
2. Align shaft walls for plumb vertical flush alignment from top to bottom of shaft.

3.5 FINISHING OF GYPSUM BOARD

- A. Finish joints, edges, corners, and fastener heads in accordance with ASTM C840. Use Level 5 finish for all finished areas open to public view.
- B. Before proceeding with installation of finishing materials, assure the following:
 1. Gypsum board is fastened and held close to framing or furring.
 2. Fastening heads in gypsum board are slightly below surface in dimple formed by driving tool.
- C. Finish joints, fasteners, and all openings, including openings around penetrations, on that part of the gypsum board extending above suspended ceilings. Sanding is not required of surfaces above suspended ceilings.

3.6 REPAIRS

- A. After taping and finishing has been completed, and before decoration, repair all damaged and defective work, including nondecorated surfaces.
- B. Patch holes or openings 13 mm (1/2 inch) or less in diameter, or equivalent size, with a setting type finishing compound or patching plaster.
- C. Repair holes or openings over 13 mm (1/2 inch) diameter, or equivalent size, with 16 mm (5/8 inch) thick gypsum board secured in such a manner as to provide solid substrate equivalent to undamaged surface.
- D. Tape and refinish scratched, abraded or damaged finish surfaces including cracks and joints in non decorated surface to provide smoke tight construction and fire protection equivalent to the fire rated construction and STC equivalent to the sound rated construction.

- - - E N D - - -

THIS PAGE INTENTIONALLY LEFT BLANK

SECTION 09 30 13
CERAMIC/PORCELAIN TILING

PART 1 - GENERAL

1.1 DESCRIPTION

This section specifies porcelain tile, marble thresholds, waterproofing membranes for thin-set applications, crack isolation membranes, and tile backer board.

1.2 RELATED WORK

- A. Sealing of joints where specified: Section 07 92 00, JOINT SEALANTS.
- B. Metal and resilient edge strips at joints with new resilient flooring, and carpeting:

1.3 QUALITY CONTROL

- A. Installer qualifications: Installer has installation experience of at least three years on projects of this size and scope.

1.4 SUBMITTALS

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Samples:
 - 1. Base tile, each type, each color, each size.
 - 2. Mosaic floor tile panels, 225 mm by 225 mm (9 inches by 9 inches), each type, color, size and pattern.
 - 3. Porcelain tile, each type, color, patterns and size.
 - 4. Wall (or wainscot) tile, each color, size and pattern.
 - 5. Trim shapes, bullnose cap and cove including bullnose cap and base pieces at internal and external corners of vertical surfaces, each type, color, and size.
- C. Product Data:
 - 1. Ceramic and porcelain tile, marked to show each type, size, and shape required.
 - 2. Chemical resistant mortar and grout.
 - 3. Cementitious backer unit.
 - 4. Crack isolation membrane.
 - 5. Divider strip.
 - 6. Reinforcing tape.
 - 7. Leveling compound.
 - 8. Latex-Portland cement mortar.
 - 9. Slip resistant tile.
 - 10. Waterproofing isolation membrane.
 - 11. Fasteners.

D. Shop Drawings:

1. Show location of each type of tile and tile pattern.
2. Show widths, details, and location of expansion, contraction, control, and isolation joints in the substrate and finished tile

DELIVERY AND STORAGE

- A. Deliver materials in containers with labels legible and intact and grade-seals unbroken.
- B. Store material to prevent damage or contamination.

1.6 APPLICABLE PUBLICATIONS

- A. Publications listed below form a part of this specification to the extent referenced. Publications are referenced in text by basic designation only. Reference most current standard.
- B. American National Standards Institute (ANSI):
 - A10.20-05 Safety Requirements for Ceramic Tile, Terrazzo, and Marble Works
 - A108.1A-05 Installation of Ceramic Tile in the Wet-Set Method with Portland Cement Mortar
 - A108.1B-05 Installation of Ceramic Tile on a Cured Portland Cement Mortar Setting Bed with dry-Set or latex-Portland Cement Mortar
 - A108.1C-05 Contractors Option; Installation of Ceramic Tile in the Wet-Set method with Portland Cement Mortar or Installation of Ceramic Tile on a Cured Portland Cement Mortar Setting Bed with Dry-Set or Latex-Portland Cement Mortar
 - A108.4-05 Installation of Ceramic Tile with Organic Adhesives or Water Cleanable Tile Setting Epoxy Adhesives
 - A108.5-05 Installation of Ceramic Tile with Dry-Set Portland Cement Mortar or Latex-Portland Cement Mortar
 - A108.6-05 Installation of Ceramic Tile with Chemical Resistant, Water Cleanable Tile-Setting and Grouting Epoxy
 - A108.8-05 Installation of Ceramic Tile with Chemical Resistant Furan Resin Mortar and Grout
 - A108.10-05 Installation of Grout in Tilework
 - A108.11-05 Interior Installation of Cementitious Backer Units

- A118.12-00Crack Isolation Membranes
- A108.13-05 Installation of Load Bearing, Bonded, Waterproof Membranes for Thin-Set Ceramic Tile and Dimension Stone
- A118.1-05 Dry-Set Portland Cement Mortar
- A118.3-05Chemical Resistant, Water Cleanable Tile-Setting Epoxy and Water Cleanable Tile-Setting and Grouting Epoxy Adhesive
- A118.4-05Latex-Portland Cement Mortar
- A118.5-05Chemical Resistant Furan Mortars and Grouts for Tile Installation
- A118.6-05 Standard Cement Grouts for Tile Installation
- A118.9-05Cementitious Backer Units
- A118.10-05Load Bearing, Bonded, Waterproof Membranes for Thin-Set Ceramic Tile and Dimension Stone Installation
- A136.1-05 Organic Adhesives for Installation of Ceramic Tile
- A137.1-88Ceramic Tile
- C. American Society For Testing And Materials (ASTM):
- A185-07 Steel Welded Wire Fabric, Plain, for Concrete Reinforcing
- C109/C109M-07 Standard Test Method for Compressive Strength of Hydraulic Cement Mortars (Using 2 inch. or [50-mm] Cube Specimens)
- C241-90 (R2005) Abrasion Resistance of Stone Subjected to Foot Traffic
- C348-02Standard Test Method for Flexural Strength of Hydraulic-Cement Mortars
- C627-93(R2007) Evaluating Ceramic Floor Tile Installation Systems Using the Robinson-Type Floor Tester
- C954-07 Steel Drill Screws for the Application of Gypsum Board on Metal Plaster Base to Steel Studs from 0.033 in (0.84 mm) to 0.112 in (2.84 mm) in thickness
- C979-05Pigments for Integrally Colored Concrete
- C1002-07Steel Self-Piercing Tapping Screws for the Application of Panel Products
- C1027-99(R2004) Determining "Visible Abrasion Resistance on Glazed Ceramic Tile"

- C1028-07Determining the Static Coefficient of Friction
of Ceramic Tile and Other Like Surfaces by
the Horizontal Dynamometer Pull Meter Method
- C1127-01 Standard Guide for Use of High Solids Content,
Cold Liquid-Applied Elastomeric Waterproofing
Membrane with an Integral Wearing Surface
- C1178/C1178M-06Standard Specification for Coated Glass Mat
Water-Resistant Gypsum Backing Panel
- D4397-02 Standard Specification for Polyethylene Sheeting
for Construction, Industrial and Agricultural
Applications
- D5109-99(R2004)Standard Test Methods for Copper-Clad
Thermosetting Laminates for Printed Wiring
Boards
- D. Marble Institute of America (MIA): Design Manual III-2007
- E. Tile Council of America, Inc. (TCA):
2007 Handbook for Ceramic Tile Installation

PART 2 - PRODUCTS

2.1 TILE

- A. Comply with ANSI A137.1, Standard Grade, except as modified:
1. Inspection procedures listed under the Appendix of ANSI A137.1.
 2. Abrasion Resistance Classification:
 - a. Tested in accordance with values listed in Table 1, ASTM C 1027.
 - b. Class V, 12000 revolutions for floors in Corridors,
Kitchens, Storage including Refrigerated Rooms
 - c. Class IV, 6000 revolutions for remaining areas.
 3. Slip Resistant Tile for Floors:
 - a. Coefficient of friction, when tested in accordance with ASTM
C1028, required for level of performance:
 - 1) Not less than 0.6 (wet condition) for bathing areas.
 - 2) Not less than 0.8 on ramps for wet and dry conditions.
 - 3) Not less than 0.6, except 0.8 on ramps as stated above, for wet
and dry conditions for other areas.
 4. Mosaic tile may be mounted or joined together by a resinous
bonding material along tile edges.
 5. Do not use back mounted tiles in showers unless certified by
manufacturer as noted in paragraph 1.3.D.
 6. Factory Blending: For tile with color variations, within the ranges
selected during sample submittals blend tile in the factory and

package so tile units taken from one package show the same range in colors as those taken from other packages and match approved samples.

7. Factory-Applied Temporary Protective Coating:

- a. Protect exposed face surfaces (top surface) of tile against adherence of mortar and grout by pre-coating with a continuous film of petroleum paraffin wax, applied hot.
- b. Do not coat unexposed tile surfaces.
- c. Pre-wax tiles set or grouted with furan or epoxy or latex modified mortars.

B. Glazed Wall Tile: Cushion edges, glazing, as specified in Drawings.

C. Porcelain Paver Tile: Nominal 8 mm (5/16 inch) thick, with cushion edges. Porcelain tile produced by the dust pressed method shall be made of approximately 50% feldspar; the remaining 50% shall be made up of various high-quality light firing ball clays yielding a tile with a water absorption rate of 0.5% or less and a breaking strength of between 390 to 400 pounds.

D. Trim Shapes:

1. Conform to applicable requirements of adjoining floor and wall tile.
2. Use trim shapes and sizes conforming to size of adjoining field wall tile unless detailed or specified otherwise in Drawings.
3. Internal and External Corners:
 - a. Square internal and external corner joints are not acceptable.
 - b. External corners including edges: Use bullnose shapes.
 - c. Internal corners: Use cove shapes.
 - d. Base to floor internal corners: Use special shapes providing integral cove vertical and horizontal joint.
 - e. Base to floor external corners: Use special shapes providing bullnose vertical edge with integral cove horizontal joint. Use stop at bottom of openings having bullnose return to wall.
 - f. Wall top edge internal corners: Use special shapes providing integral cove vertical joint with bullnose top edge.
 - g. Wall top edge external corners: Use special shapes providing bullnose vertical and horizontal joint edge.
 - h. Provide cove and bullnose shapes where

shown. 2.2 CEMENTITIOUS BACKER UNITS

- A. Use in showers or wet areas.
- B. ANSI A118.9.
- C. Use Cementitious backer units in maximum available lengths.
- D. Backer unit meet or exceed the following additional physical properties:

<u>Property</u>	<u>Test Method</u>	<u>Value</u>
Water absorption	ASTM C948	Less than 20 percent by weight

2.3 JOINT MATERIALS FOR CEMENTITIOUS BACKER UNITS

- A. Reinforcing Tape: Vinyl coated woven glass fiber mesh tape, open weave, 50 mm (2 inches) wide. Tape with pressure sensitive adhesive backing will not be permitted.
- B. Tape Embedding Material: Latex-Portland cement mortar complying with ANSI A118.4.
- C. Joint material, including reinforcing tape, and tape embedding material, shall be as specifically recommended by the backer unit manufacturer.

2.4 FASTENERS

- A. Screws for Cementitious Backer Units.
 - 1. Standard screws for gypsum board are not acceptable.
 - 2. Minimum 11 mm (7/16 inch) diameter head, corrosion resistant coated, with washers.
 - 3. ASTM C954 for steel 1 mm (0.033 inch) thick.
 - 4. ASTM C1002 for steel framing less than 0.0329 inch thick.
- B. Washers: Galvanized steel, 13 mm (1/2 inch) minimum

diameter. 2.5 SETTING MATERIALS OR BOND COATS

- A. Conform to TCA Handbook for Ceramic Tile Installation.
- B. Latex-Portland Cement Mortar
 - 1. When using an impervious porcelain tile provide manufacturer's product with a bond strength of 400 psi.
 - 2. For wall applications, provide non-sagging, Portland cement mortar complying with ANSI A118.4.
 - 3. Prepackaged Dry-Mortar Mix: Factory-prepared mixture of Portland cement; dry, redispersible, ethylene vinyl acetate additive; and other ingredients to which only water needs to be added at Project site.
 - 4. For recessed concrete slab applications, provide latex/polymer modified Portland Cement in medium bed mortar.
- C. Urethane Waterproofing and Tile-Setting Adhesive: One-Part Liquid-Applied Urethane in a consistency suitable for trowel application and intended for use as both waterproofing and tile-setting adhesive in a two-step process.
- D. Waterproofing Isolation Membrane:
 - 1. Sheet System ANSI A118.10.
 - 2. Optional System to elastomeric waterproof membrane.

3. Composite sheet consisting of ASTM D5109, Type II, Grade I Chlorinated Polyethylene (CM) sheet reinforced on both sides with a non-woven polyester fiber.
4. Designed for use in wet areas as an isolation and positive waterproofing membranes for thin-set bonding of sheet to substrate and thin-set bonding of ceramic and porcelain tile or marble to sheet. Suited for both horizontal and vertical applications.
5. Conform to the following additional physical properties:

Property	Units	Results	Test Method
Hardness Shore A	Points	70-80	ASTM D2240 (10 Second Reading)
Shrinkage	Percent	5 maximum	ASTM D1204
Brittleness		No crack remains flexible at temperature-37 degrees C (-25 degrees F)	ASTM D2497 13 mm (1/2- inch) Mandrel Bend
Retention of Properties after Heat Aging	Percent of original	80 Tensile 80 Breaking 80 Elongation	ASTM D3045, 90 degrees C (194 degrees F) for 168 hours

6. Manufacturer's standard sheet size with prefabricated or preformed inside and outside corners.
7. Sheet manufacturer's solvent welding liquid or xylene and edge sealant.

2.6 GROUTING MATERIALS

- A. Chemical-Resistant Grout: 1.
Epoxy grout, ANSI A118.3.
- B. Grout Sealer:
 1. Manufacturer's standard silicone product for sealing grout joints that does not change color or appearance of grout.

2.7 PATCHING AND LEVELING COMPOUND

- A. Portland cement base, polymer-modified, self-leveling compound, manufactured specifically for resurfacing and leveling concrete floors. Products containing gypsum are not acceptable.
- B. Shall have minimum following physical properties:
 1. Compressive strength - 25 MPa (3500 psig) per ASTM C109/C109M.
 2. Flexural strength - 7 MPa (1000 psig) per ASTM C348 (28 day value).
 3. Tensile strength - 600 psi per ANSI 118.7.
 4. Density - 1.9.

- C. Capable of being applied in layers up to 38 mm (1-1/2 inches) thick without fillers and up to 100 mm (four inches) thick with fillers, being brought to a feather edge, and being trowelled to a smooth finish.
- D. Primers, fillers, and reinforcement as required by manufacturer for application and substrate condition.
- E. Ready for use in 48 hours after application.

2.8 MARBLE

- A. Soundness Classification in accordance with MIA Design Manual III Groups.
- B. Thresholds:
 1. Group A, Minimum abrasive hardness (Ha) of 10.0 per ASTM C241.
 2. Honed finish on exposed faces.
 3. Fabricate from one piece without holes, cracks, or open seams; full depth of wall or frame opening by full width of wall or frame opening; 19 mm (3/4-inch) minimum thickness and 6 mm (1/4-inch) minimum thickness at beveled edge.
 4. Set not more than 13 mm (1/2-inch) above adjoining finished floor surfaces, with transition edges beveled on a slope of no greater than 1:2. On existing floor slabs provide 13 mm (1/2-inch) above ceramic tile surface with bevel edge joint top flush with adjacent floor.
 5. One piece full width of door opening. Notch thresholds to match profile of door jambs.

2.9 METAL DIVIDER STRIPS

- A. Aluminum as specified.

2.10 WATER

- A. Clean, potable and free from salts and other injurious elements to mortar and grout materials.

2.11 CLEANING COMPOUNDS

- A. Specifically designed for cleaning masonry and concrete and which will not prevent bond of subsequent tile setting materials including patching and leveling compounds and elastomeric waterproofing membrane and coat.
- B. Materials containing acid or caustic material not acceptable.

2.12 POLYETHYLENE SHEET

- A. Polyethylene sheet conforming to ASTM D4397.
- B. Nominal thickness: 0.15 mm (six mils).
- C. Use sheet width to minimize joints.

2.13 CRACK ISOLATION MEMBRANE

- A. Chlorinated-Polyethylene Sheet: Non-plasticized, chlorinated polyethylene faced on both sides with non-woven polyester fabric; 0.76 mm (0.030 inch) nominal thickness.

PART 3 - EXECUTION

3.1 ENVIRONMENTAL REQUIREMENTS

- A. Maintain ambient temperature of work areas at not less than 16 degree C (60 degrees F), without interruption, for not less than 24 hours before installation and not less than three days after installation.
- B. Maintain higher temperatures for a longer period of time where required by manufacturer's recommendation and ANSI Specifications for installation.
- C. Do not install tile when the temperature is above 38 degrees C (100 degrees F).
- D. Do not install materials when the temperature of the substrate is below 16 degrees C (60 degrees F).
- E. Do not allow temperature to fall below 10 degrees C (50 degrees F) after fourth day of completion of tile work.

3.2 ALLOWABLE TOLERANCE

- A. Variation in plane of sub-floor, including concrete fills leveling compounds and mortar beds:
 - 1. Not more than 1 in 500 (1/4 inch in 10 feet) from required elevation where Portland cement mortar setting bed is used.
 - 2. Not more than 1 in 1000 (1/8 inch in 10 feet) where dry-set Portland cement, and latex-Portland cement mortar setting beds and chemical-resistant bond coats are used.
- B. Variation in Plane of Wall Surfaces:
 - 1. Not more than 1 in 400 (1/4 inch in eight feet) from required plane where Portland cement mortar setting bed is used.
 - 2. Not more than 1 in 800 (1/8 inch in eight feet) where dry-set or latex-Portland cement mortar or organic adhesive setting materials is used.

3.3 SURFACE PREPARATION

- A. Cleaning New Concrete:
 - 1. Chip out loose material, clean off all oil, grease dirt, adhesives, curing compounds, and other deterrents to bonding by mechanical method, or by using products specifically designed for cleaning concrete and masonry.

2. Use self-contained power blast cleaning systems to remove curing compounds and steel trowel finish from concrete slabs where ceramic tile will be installed directly on concrete surface with thin-set materials.
3. Steam cleaning or the use of acids and solvents for cleaning will not be permitted.

B. Patching and Leveling:

1. Mix and apply patching and leveling compound in accordance with manufacturer's instructions.
2. Fill holes and cracks and align concrete floors that are out of required plane with patching and leveling compound.
 - a. Thickness of compound as required to bring finish tile system to elevation shown.
 - b. Float finish.
 - c. At substrate expansion, isolation, and other moving joints, allow joint of same width to continue through underlayment.
3. Apply leveling coats of material compatible with wall surface and tile setting material to wall surfaces.

C. Mortar Bed for Slopes to Drains:

1. Slope compound to drain where drains are shown.
2. Install mortar bed in depressed slab sloped to drains.
3. Allow not less than 50 mm (2 inch) depression at edge of depressed slab.
4. Screed for slope to drain and float finish.
5. Cure mortar bed for not less than seven days. Do not use curing compounds or coatings.

D. Walls:

1. In showers or other wet areas cover studs with polyethylene sheet.
2. Apply leveling coats of material compatible with wall surface and tile setting material to wall surfaces, other than concrete and masonry that are out of required plane.

3.4 CEMENTITIOUS BACKER UNITS

- A. Remove polyethylene wrapping from cementitious backer units and separate to allow for air circulation. Allow moisture content of backer units to dry down to a maximum of 35 percent before applying joint treatment and tile.
- B. Install in accordance with ANSI A108.11 except as specified otherwise.

- C. Install units horizontally or vertically to minimize joints with end joints over framing members. Units with rounded edges; face rounded edge away from studs to form a V joint for joint treatment.
- D. Secure cementitious backer units to each framing member with screws spaced not more than 200 mm (eight inches) on center and not closer than 13 mm (1/2 inch) from the edge of the backer unit or as recommended by backer unit manufacturer. Install screws so that the screw heads are flush with the surface of the backer unit.
- E. Where backer unit joins shower pans or waterproofing, lap backer unit over turned up waterproof system. Install fasteners only through top one-inch of turned up waterproof systems.
- F. Do not install joint treatment for seven days after installation of cementitious backer unit.
- G. Joint Treatment:
 - 1. Fill horizontal and vertical joints and corners with latex-Portland cement mortar. Apply fiberglass tape over joints and corners and embed with same mortar.
 - 2. Leave 6 mm (1/4 inch) space for sealant at lips of tubs, sinks, or other plumbing receptors.

3.5 MARBLE

- A. Secure thresholds and stools in position with minimum of two stainless steel dowels.
- B. Set in dry-set Portland cement mortar or latex-Portland cement mortar bond coat.
- C. Set threshold to finish 12mm (1/2 inch) above ceramic tile floor unless shown otherwise, with bevel edge joint top flush with adjacent floor similar to TCA detail TR611-09.

3.6 METAL DIVIDER STRIPS

- A. Install metal divider strips in floor joints between tile floors and adjacent flooring of other materials where the finish floors are flush unless shown otherwise.
- B. Set divider strip in mortar bed to line and level centered under doors or in openings.
- C. At preformed sealant joint: Refer to Section 07 95 13, EXPANSION JOINT COVER ASSEMBLIES.
 - 1. Comply with recommendations in TCA "Handbook for Ceramic Tile Installation" Vertical and Horizontal Joint Design Essentials. TCA System EJ 171-02.

- a. Locate joint in tile surfaces directly above joint in sub-floor or where indicated when used with isolation membranes to allow off-setting of joint location from sub-floor joint.
 - b. Fasten full length to sub-floor using a construction adhesive.
 - c. Trowel setting material with full coverage over the entire leg. 2.
- Set tile up against the joint ensuring that the top edge of the joint is flush or slightly below the top of the tile.

3.7 CERAMIC TILE - GENERAL

- A. Comply with ANSI A108 series of tile installation standards in "Specifications for Installation of Ceramic Tile" applicable to methods of installation.
- B. Comply with TCA Installation Guidelines:
- C. Installing Mortar Beds for Floors:
 1. Install mortar bed to not damage cleavage or waterproof membrane; 32 mm (1-1/2 inch) minimum thickness.
 2. Install floor mortar bed reinforcing centered in mortar fill.
 3. Screed finish to level plane or slope to drains where shown, float finish.
 4. For thin set systems cure mortar bed not less than seven days. Do not use curing compounds or coatings.
 5. For tile set with Portland cement paste over plastic mortar bed coordinate to set tile before mortar bed sets.
- D. Setting Beds or Bond Coats:
 1. Where recessed or depressed floor slabs are filled with Portland cement mortar bed, set ceramic mosaic floor tile in either Portland cement paste over plastic mortar bed or latex-Portland cement in medium mortar bed except as specified otherwise.
 2. Set wall tile installed over cementitious backer board in latex-Portland cement mortar, ANSI A108.1B.
 3. Set trim shapes in same material specified for setting adjoining tile.
- E. Workmanship:
 1. Lay out tile work so that no tile less than one-half full size is used. Make all cuts on the outer edge of the field.
 2. Set tile firmly in place with finish surfaces in true planes. Align tile flush with adjacent tile unless shown otherwise.
 3. Form intersections and returns accurately.
 4. Cut and drill tile neatly without marring surface.
 5. Cut edges of tile abutting penetrations, finish, or built-in items:

- a. Fit tile closely around electrical outlets, piping, fixtures and fittings, so that plates, escutcheons, collars and flanges will overlap cut edge of tile.
 - b. Seal tile joints water tight, around electrical outlets, piping fixtures and fittings before cover plates and escutcheons are set in place.
6. Completed work shall be free from hollow sounding areas and loose, cracked or defective tile.
 7. Remove and reset tiles that are out of plane or misaligned.
 8. Floors:
 - a. Extend floor tile beneath casework and equipment, except those units mounted in wall recesses.
 - b. Align finish surface of new tile work flush with other and existing adjoining floor finish where shown.
 - c. In areas where floor drains occur, slope to drains where shown.
 - d. Shove and vibrate tiles over 200 mm (8 inches) square to achieve full support of bond coat.
 9. Walls:
 - a. Cover walls and partitions, including pilasters, furred areas, and freestanding columns from floor to ceiling, or from floor to nominal wainscot heights shown with tile.
 - b. Finish reveals of openings with tile, except where other finish materials are shown or specified.
 10. Joints:
 - a. Keep all joints in line, straight, level, perpendicular and of even width unless shown otherwise.
 - b. Make joints in porcelain tile according to manufacturer's recommendations.
 11. Back Battering: For installations indicated below, obtain 100 percent mortar coverage by complying with applicable special requirements for back buttering of tile in referenced ANSI A108 series of tile installation standards:
 - a. Tile wall installations in wet areas, including showers.
 - b. Tile installed with chemical-resistant mortars and grouts.
 - c. Tile wall installations composed of tiles 200 by 200 mm (8 by 8 inches or larger).

3.8 CERAMIC TILE INSTALLED WITH PORTLAND CEMENT MORTAR

- A. Mortar Mixes for Floor, Wall And Base Tile (including Showers):
ANSI A108.1.except specified otherwise.

- B. Installing Wall and Base Tile: ANSI A108.1, except specified otherwise.
- C. Installing Floor Tile: ANSI A108.1, except as specified otherwise.
Slope as indicated on Drawings.

3.9 THIN SET CERAMIC AND PORCELAIN TILE INSTALLED WITH DRY-SET PORTLAND CEMENT AND LATEX-PORTLAND CEMENT MORTAR

- A. Installation of Tile: ANSI A108.5, except as specified otherwise.

3.10 THIN SET CERAMIC AND PORCELAIN TILE INSTALLED WITH CHEMICAL-RESISTANT BOND COAT

- A. Epoxy Resin Type: Install tile in accordance with Installation of Tile with Epoxy Mortar; ANSI A108.6.

3.11 GROUTING

- A. Grout Type and Location:
 - 1. Grout for glazed wall and base tile, paver tile and unglazed mosaic tile Portland cement grout, latex-Portland cement grout, dry-set grout, or commercial Portland cement grout.
- B. Workmanship:
 - 1. Install and cure grout in accordance with the applicable standard.
 - 2. Epoxy Grout: ANSI A108.6.

3.12 MOVEMENT JOINTS

- A. Prepare tile expansion, isolation, construction and contraction joints for installation of sealant. Refer to Section 07 92 00, JOINT SEALANTS.
- B. TCA details EJ 171-02.
- C. At expansion joints, rake out joint full depth of tile and setting bed and mortar bed. Do not cut waterproof or isolation membrane.
- D. Rake out grout at joints between tile and at toe of base, not less than 6 mm (1/4 inch) deep.

3.13 CLEANING

- A. Thoroughly sponge and wash tile. Polish glazed surfaces with clean dry cloths.
- B. Methods and materials used shall not damage or impair appearance of tile surfaces.
- C. The use of acid or acid cleaners on glazed tile surfaces is prohibited.
- D. Clean tile grouted with epoxy, furan and commercial Portland cement grout and tile set in elastomeric bond coat as recommended by the manufacturer of the grout and bond coat.

3.14 PROTECTION

- A. Keep traffic off tile floor, until grout and setting material is firmly set and cured.
- B. Where traffic occurs over tile floor, cover tile floor with not less than 9 mm (3/8 inch) thick plywood, wood particle board, or hardboard

securely taped in place. Do not remove protective cover until time for final inspection. Clean tile of any tape, adhesive and stains.

- - - E N D - - -

**SECTION 09 51 00
ACOUSTICAL CEILINGS**

PART 1- GENERAL

1.1 DESCRIPTION

- A. Metal ceiling suspension system for acoustical ceilings.
- B. Acoustical units.

1.2 RELATED WORK

- A. Pattern, and location of each type of acoustical unit: As indicated on Drawings.
- B. Seismic Restraint: Section 13 05 41, Seismic Restraint Requirements for Non-Structural Components.

1.3 SUBMITTAL

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Samples:
 - 1. Acoustical units, each type, with label indicating conformance to specification requirements.
 - 2. Colored markers for units providing access.
- C. Manufacturer's Literature and Data:
 - 1. Ceiling suspension system, each type, showing complete details of installation.
 - 2. Acoustical units, each type

1.4 DEFINITIONS

- A. Standard definitions as defined in ASTM C634.
- B. Terminology as defined in ASTM

E1264. 1.5 APPLICABLE PUBLICATIONS

- A. Publications listed below form a part of this specification to extent referenced. Publications are referenced in the text by basic designation only.
- B. American Society for Testing and Materials (ASTM):
 - A641/A641M-03 Zinc-coated (Galvanized) Carbon Steel Wire
 - A653/A653M-07 Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-coated (Galvannealed) by the Hot-Dip Process
 - C423-07 Sound Absorption and Sound Absorption Coefficients by the Reverberation Room Method
 - C634-02 (E2007) Standard Terminology Relating to Environmental Acoustics

C635-04	.....	Metal Suspension Systems for Acoustical Tile and Lay-in Panel Ceilings
C636-06	.....	Installation of Metal Ceiling Suspension Systems for Acoustical Tile and Lay-in Panels
E84-07	.....	Surface Burning Characteristics of Building Materials
E119-07	.....	Fire Tests of Building Construction and Materials
E413-04	.....	Classification for Rating Sound Insulation.
E580-06	.....	Application of Ceiling Suspension Systems for Acoustical Tile and Lay-in Panels in Areas Requiring Seismic Restraint
E1264-(R2005)	.....	Classification for Acoustical Ceiling Products

PART 2- PRODUCTS

2.1 METAL SUSPENSION SYSTEM

- A. Basis-of-Design: Subject to compliance with requirements provide the following or approved equal product.
 - 1. Armstrong World Industries, Inc. Suprafine XL, 9/16" exposed tee system.
- B. Exposed grid suspension system for support of lay-in panels:
 - 1. Exposed grid width not less than 14.22 mm (9/6 inch) panel bearing surface.
 - 2. Fabricate wall molding and other special molding from the same material with same exposed width and finish as the exposed grid members.
 - 3. On exposed metal surfaces apply baked-on enamel flat texture finish in color to match adjacent acoustical units unless specified otherwise on Drawings.

2.2 PERIMETER SEAL

- A. Vinyl, polyethylene or polyurethane open cell sponge material having density of 1.3 plus or minus 10 percent, compression set less than 10 percent with pressure sensitive adhesive coating on one side.
- B. Thickness as required to fill voids between back of wall molding and finish wall.
- C. Not less than 9 mm (3/8 inch) wide

strip. 2.3 WIRE

- A. ASTM A641.
- B. For wire hangers: Minimum diameter 2.68 mm (0.1055 inch).
- C. For bracing wires: Minimum diameter 3.43 mm (0.1350 inch).

2.4 ANCHORS AND INSERTS

- A. Use anchors or inserts to support twice the loads imposed by hangers attached thereto.
- B. Hanger Inserts:
1. Fabricate inserts from steel, zinc-coated (galvanized after fabrication).
 2. Flush ceiling insert type:
 - a. Designed to provide a shell covered opening over a wire loop to permit attachment of hangers and keep concrete out of insert recess.
 - b. Insert opening inside shell approximately 16 mm (5/8 inch) wide by 9 mm (3/8 inch) high over top of wire.
 - c. Wire 5 mm (3/16 inch) diameter with length to provide positive hooked anchorage in concrete.
- C. Clips:
1. Galvanized steel.
 2. Designed to clamp to steel beam or bar joists, or secure framing member together.
 3. Designed to rigidly secure framing members together.
 4. Designed to sustain twice the loads imposed by hangers or items supported.
- D. Tile Splines: ASTM C635.

2.5 CARRYING CHANNELS FOR SECONDARY FRAMING

- A. Fabricate from cold-rolled or hot-rolled steel, black asphaltic paint finish, free of rust.
- B. Weighing not less than the following, per 300 m (per thousand linear feet):

Size mm	Size Inches	Cold-rolled		Hot-rolled	
		Kg	Pound	Kg	Pound
38	1 1/2	215.4	475	508	1120
50	2	267.6	590	571.5	1260

2.6 ACOUSTICAL UNITS

- A. General:
1. Ceiling Tile shall meet minimum 37% bio-based content in accordance with USDA Bio-Preferred Product requirements.
 2. ASTM E1264, weighing 3.6 kg/m² (3/4 psf) minimum for mineral fiber panels or tile.

- 3. Class A Flame Spread: ASTM 84
- 4. Minimum NRC (Noise Reduction Coefficient): 0.55 unless specified otherwise: ASTM C423.
- 5. Minimum CAC (Ceiling Attenuation Class): 40-44 range unless specified otherwise: ASTM E413.
- 6. Manufacturers standard finish, minimum Light Reflectance (LR) coefficient of 0.75 on the exposed surfaces, except as specified otherwise in Drawings.
- 7. Lay-in panels: Sizes as shown per tile as specified: a. Basis-of-Design: SAC1: Armstrong World Industries, Inc., Cortega Second Look II, 15/16" Angled Tegular, Lay-In #2767, Size: 2' x 4' x 3/4" thickness, Color: White.

2.7 ACCESS IDENTIFICATION

- A. Markers; Contractor shall be responsible for installing access identification for their own work.
 - 1. Use colored markers with pressure sensitive adhesive on one side.
 - 2. Make colored markers of paper or plastic, 6 to 9 mm (1/4 to 3/8 inch) in diameter.
- B. Use markers of the same diameter throughout building.
- C. Color Code: Use following color markers for service identification:

Color	.....Service
Red	.....Sprinkler System: Valves and Controls
Green	.....Domestic Water: Valves and Controls
Yellow	.....Chilled Water and Heating Water
Orange	.....Ductwork: Fire Dampers
Blue	.....Ductwork: Dampers and Controls
Black	.....Gas: Laboratory, Medical, Air and Vacuum
- D. The contractor installing the above listed service(s) shall be responsible for installing required colored markers for their own work. Contractor removing existing suspended ceilings shall be responsible for installing new color coded markers in locations that had markers.

PART 3 EXECUTION

3.1 CEILING TREATMENT

- A. Treatment of ceilings shall include sides and soffits of ceiling beams, furred work 600 mm (24 inches) wide and over, and vertical surfaces at changes in ceiling heights unless otherwise shown. Install acoustic tiles after wet finishes have been installed and solvents have cured.

B. Lay out acoustical units symmetrically about center lines of each room or space unless shown otherwise on reflected ceiling plan.

C. Moldings:

1. Install metal wall molding at perimeter of room, column, or edge at vertical surfaces.
2. Install special shaped molding at changes in ceiling heights and at other breaks in ceiling construction to support acoustical units and to conceal their edges.

D. Perimeter Seal:

1. Install perimeter seal between vertical leg of wall molding and finish wall, partition, and other vertical surfaces.
2. Install perimeter seal to finish flush with exposed faces of horizontal legs of wall molding.

3.2 CEILING SUSPENSION SYSTEM INSTALLATION

A. General:

1. Install metal suspension system for acoustical tile and lay-in panels in accordance with ASTM C636, except as specified otherwise.
2. Use direct or indirect hung suspension system or combination thereof as defined in ASTM C635.
3. Support a maximum area of 1.48 m² (16 sf) of ceiling per hanger.
4. Prevent deflection in excess of 1/360 of span of cross runner and main runner.
5. Provide extra hangers, minimum of one hanger at each corner of each item of mechanical, electrical and miscellaneous equipment supported by ceiling suspension system not having separate support or hangers.
6. Provide not less than 100 mm (4 inch) clearance from the exposed face of the acoustical units to the underside of ducts, pipe, conduit, secondary suspension channels, concrete beams or joists; and steel beam or bar joist unless furred system is shown,
7. Use main runners not less than 1200 mm (48 inches) in length.
8. Install hanger wires vertically. Angled wires are not acceptable except for seismic restraint bracing wires.
9. Install end hangers at 200 mm (8 inches) maximum from wall, for main and cross runners.
10. Attach hangers to main and cross runners to allow easy removal of acoustical tile and lay-in panels. All hangers shall be taut with 3 complete turns around self.

B. Anchorage to Structure:

1. Concrete:

- a. Install hanger inserts and wire loops required for support of hanger and bracing wire in concrete forms before concrete is placed. Install hanger wires with looped ends through steel deck if steel deck does not have attachment device.
 - b. Use eye pins or threaded studs with screw-on eyes in existing or already placed concrete structures to support hanger and bracing wire. Install in sides of concrete beams or joists at mid height.
2. Steel:
- a. When steel framing does not permit installation of hanger wires at spacing required, install carrying channels for attachment of hanger wires.
 - (1) Size and space carrying channels to insure that the maximum deflection specified will not be exceeded.
 - (2) Attach hangers to steel carrying channels, spaced four feet on center, unless area supported or deflection exceeds the amount specified.
 - b. Attach carrying channels to the bottom flange of steel beams spaced not more than 1200 mm (4 feet) on center before fire proofing is installed. Weld or use steel clips to attach to beam to develop full strength of carrying channel.
 - c. Attach hangers to bottom chord of bar joists or to carrying channels installed between the bar joists when hanger spacing prevents anchorage to joist. Rest carrying channels on top of the bottom chord of the bar joists, and securely wire tie or clip to joist.
- C. Direct Hung Suspension System:
1. As illustrated in ASTM C635.
 2. Support main runners by hanger wires attached directly to the structure overhead.
 3. Maximum spacing of hangers, 1200 mm (4 feet) on centers unless interference occurs by mechanical systems. Use indirect hung suspension system where not possible to maintain hanger spacing.
- D. Indirect Hung Suspension System:
1. As illustrated in ASTM C635.
 2. Space carrying channels for indirect hung suspension system not more than 1200 mm (4 feet) on center. Space hangers for carrying channels not more than 2400 mm (8 feet) on center or for carrying channels less than 1200 mm (4 feet) on center so as to insure that specified requirements are not exceeded.

3. Support main runners by specially designed clips attached to carrying channels.

E. Seismic Ceiling Bracing System:

1. Construct system in accordance with ASTM E580.
2. Connect bracing wires to structure above as specified for anchorage to structure and to main runner or carrying channels of suspended ceiling at bottom.

3.3 ACOUSTICAL UNIT INSTALLATION

- A. Cut acoustic units for perimeter borders and penetrations to fit tight against penetration for joint not concealed by molding.
- B. Install lay-in acoustic panels in exposed grid with not less than 6 mm (1/4 inch) bearing at edges on supports.
 1. Install tile to lay level and in full contact with exposed grid.
 2. Replace cracked, broken, stained, dirty, or tile not cut for minimum bearing.
- C. Markers:
 1. Install markers of color code specified to identify the various concealed piping, mechanical, and plumbing systems.
 2. Attach colored markers to exposed grid on opposite sides of the units providing access.
 3. Attach marker on exposed ceiling surface of upward access acoustical unit.

3.5 CLEAN-UP AND COMPLETION

- A. Replace damaged, discolored, dirty, cracked and broken acoustical units.
- B. Leave finished work free from defects. -

- - E N D - - -

THIS PAGE INTENTIONALLY LEFT BLANK

**SECTION 09 65 13
RESILIENT BASE AND ACCESSORIES**

PART 1 - GENERAL

1.1 DESCRIPTION

This section specifies the installation of vinyl or rubber base.

1.2 RELATED WORK

- A. Color and texture: As indicated on Drawings.
- B. Integral base with sheet flooring: Section 09 65 16, RESILIENT SHEET FLOORING.
- C. Carpet base with carpeting at rooms indicated in Finish Schedule: Section 09 68 00, CARPETING.

1.3 SUBMITTALS

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Manufacturer's Literature and Data:
 - 1. Description of each product.
 - 2. Base material manufacturer's recommendations for adhesives.
 - 3. Application and installation instructions.
- C. Samples:
 - 1. Base: 150 mm (6 inches) long, each type and color.
 - 2. Adhesive: Literature indicating each

type. **1.4 DELIVERY**

- A. Deliver materials to the site in original sealed packages or containers, clearly marked with the manufacturer's name or brand, type and color, production run number and date of manufacture.
- B. Materials from containers which have been distorted, damaged or opened prior to installation will be rejected.

1.5 STORAGE

- A. Store materials in weather tight and dry storage facility.
- B. Protect material from damage by handling and construction operations before, during, and after installation.

1.6 APPLICABLE PUBLICATIONS

- A. The publication listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.
- B. American Society for Testing and Materials (ASTM):
 - F1344-04 Rubber Floor Tile
 - F1859-04 Rubber Sheet Floor Covering without Backing
 - F1860-04 Rubber Sheet Floor Covering with Backing

F1861-02 Resilient Wall Base

C. Federal Specifications (Fed. Spec.):

RR-T-650E Treads, Metallic and Non-Metallic, Nonskid

PART 2 - PRODUCTS

2.1 GENERAL

Use only products by the same manufacturer and from the same production run.

2.3 RESILIENT BASE (RB1)

A. Basis-of-Design: Subject to compliance with requirement, provide the following or approved equal product:

1. Johnsonite, Inc., Millwork Resilient Wall Base.

B. ASTM F1861, 3.17 mm (1/8 inch) thick, 15.24 cm (6 inches) high, Type TP Rubber, Thermoplastics, Group 1 (solid). Style DC-cove.

2.3 RESILIENT BASE (RB2)

A. Basis-of-Design: Subject to compliance with requirement, provide the following or approved equal product:

1. Johnsonite, Inc., Traditional Wall Base.

B. ASTM F1861, 6.35 mm (1/4 inch) thick, 15.24 cm (6 inches) high, Type TP Rubber, Thermoplastics, Group 1: Millwork, Style "Attache".

2.4 PRIMER (FOR CONCRETE FLOORS)

As recommended by the adhesive and tile manufacturer.

2.5 LEVELING COMPOUND (FOR CONCRETE FLOORS)

Provide products with latex or polyvinyl acetate resins in the mix.

2.6 ADHESIVES

A. Use products recommended by the material manufacturer for the conditions of use.

B. Use low-VOC adhesive during installation. Water based adhesive with low VOC is preferred over solvent based adhesive.

PART 3 - EXECUTION

3.1 PROJECT CONDITIONS

A. Maintain temperature of materials above 21° C (70 °F), for 48 hours before installation.

B. Maintain temperature of rooms where work occurs, between 21° C and 27° C (70°F and 80°F) for at least 48 hours, before, during, and after installation.

C. Do not install materials until building is permanently enclosed and wet construction is complete, dry, and cured.

3.2 INSTALLATION REQUIREMENTS

- A. The respective manufacturer's instructions for application and installation will be considered for use when approved by the COTR.
- B. Submit proposed installation deviation from this specification to the COTR indicating the differences in the method of installation.
- C. The COTR reserves the right to have test portions of material installation removed to check for non-uniform adhesion and spotty adhesive coverage.

3.3 PREPARATION

- A. Examine surfaces on which material is to be installed.
- B. Fill cracks, pits, and dents with leveling compound.
- C. Level to 3 mm (1/8 inch) maximum variations.
- D. Do not use adhesive for leveling or filling.
- E. Grind, sand, or cut away protrusions; grind high spots.
- F. Clean substrate area of oil, grease, dust, paint, and deleterious substances.
- G. Substrate area dry and cured. Perform manufacturer's recommended bond and moisture test.

3.4 BASE INSTALLATION

- A. Location:
 - 1. Unless otherwise specified or shown, where base is scheduled, install base over toe space of base of casework, lockers, laboratory, pharmacy furniture island cabinets and where other equipment occurs.
 - 2. Extend base scheduled for room into adjacent closet, alcoves, and around columns.
- B. Application:
 - 1. Apply adhesive uniformly with no bare spots.
 - 2. Set base with joints aligned and butted to touch for entire height.
 - 3. Before starting installation, layout base material to provide the minimum number of joints with no strip less than 600 mm (24 inches) length.
 - a. Short pieces to save material will not be permitted.
 - b. Locate joints as remote from corners as the material lengths or the wall configuration will permit.
- C. Job-Form corners and end stops as follows:
 - 1. Score back of outside corner.
 - 2. Score face of inside corner and notch cove.
- D. Roll base for complete adhesion.

3.5 CLEANING AND PROTECTION

- A. Clean all exposed surfaces of base and adjoining areas of adhesive spatter before it sets.
- B. Keep traffic off resilient material for at least 72 hours after installation.
- C. Clean and polish materials in the following order:
 - 1. After two weeks, scrub resilient base, with a minimum amount of water and a mild detergent. Leave surfaces clean and free of detergent residue. Polish resilient base to a gloss finish.
- D. Where protective materials are removed and immediately prior to acceptance, replace damaged materials and re-clean resilient materials. Damaged materials are defined as having cuts, gouges, scrapes or tears and not fully adhered.

- - - E N D - - -

**SECTION 09 65 16
RESILIENT SHEET FLOORING**

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This Section specifies the installation of sheet flooring with backing and integral cove base.
- B. Grades of resilient sheet vinyl floor covering without backing having vinyl plastic wearlayer with backing.
- C. Installation of sheet flooring including following:
 - 1. Heat welded seams.
 - 2. Integral cove base: Installed at intersection of floor and vertical surfaces.

1.2 RELATED WORK

- A. Concrete floors: Section 03 30 00, CAST-IN-PLACE CONCRETE.
- B. Color, pattern and texture: As indicated on Drawings.
- C. Resilient base over base of lockers, equipment and casework: Section 09 65 13, RESILIENT BASE AND ACCESSORIES.

1.3 QUALITY CONTROL-QUALIFICATIONS:

- A. The Contracting Officer shall approve products or service of proposed manufacturer, suppliers, and installers, and the Contractor shall submit certification that:
 - 1. Heat welded seaming is manufacturer's prescribed method of installation.
 - 2. Installer is approved by manufacturer of materials and has technical qualifications, experience, trained personnel, and facilities to install specified items.
 - 3. Manufacturer's product submitted has been in satisfactory operation, on three installations similar and equivalent in size to this project for three years. Submit list of installations.
- B. The sheet vinyl floor coverings shall meet fire performance characteristics as determined by testing products, per ASTM test method, indicated below by Underwriters Laboratories, Inc. (UL) or another recognized testing and inspecting agency acceptable to authorities having jurisdiction.
 - 1. Critical Radiant Flux: 0.45 watts per sq. cm or more, Class I, per ASTM E648.
 - 2. Smoke Density: Less than 450 per ASTM E662.
- C. The floor covering manufacturer shall certify that products supplied for installation comply with local regulations controlling use of volatile organic compounds (VOC's).

1.4 SUBMITTALS

- A. In accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES, submit following:
- B. Manufacturer's Literature and Data:
 - 1. Description of resilient material and accessories to be provided.
 - 2. Resilient material manufacturer's recommendations for adhesives, weld rods, sealants, and underlayment.
 - 3. Application and installation instructions.
- C. Samples:
 - 1. Sheet material, 38 mm by 300 mm (1-1/2 inch by 12 inch), of each color and pattern with a welded seam using proposed welding rod 300 mm (12 inches) square for each type, pattern and color.
 - 2. Cap strip and fillet strip, 300 mm (12 inches) for integral base.
 - 3. Shop Drawings and Certificates: Layout of joints showing patterns where joints are expressed, and type and location of obscure type joints, edges, columns, doorways, enclosing partitions, built-in furniture, cabinets and cut-outs. Indicate orientation of directional patterns.
 - 4. Certificates: Quality Control Certificate Submittals and lists specified in paragraph, QUALIFICATIONS.
 - 5. Edge strips: 150 mm (6 inches) long each type.
 - 6. Adhesive, underlayment and primer: Pint container, each

type. 1.5 PROJECT CONDITIONS

- A. Maintain temperature of floor materials and room, where work occurs, above 18 °C (65 °F) and below 38 °C (100 °F) for 48 hours before, during and for 48 hours after installation. After above period, room temperature shall not fall below 13 °C (55 °F), and as recommended by floor covering manufacturer.
- B. Construction in or near areas to receive flooring work shall be complete, dry and cured. Do not install resilient flooring over slabs until they have been cured and are sufficiently dry to achieve a bond with adhesive. Follow flooring manufacturer's recommendations for bond and moisture testing.
- C. Building shall be permanently enclosed. Schedule construction so that floor receives no construction traffic when completed.

1.6 DELIVERY, STORAGE AND HANDLING

- A. Deliver materials to site in original sealed packages or containers; labeled for identification with manufacturer's name and brand.

- B. Deliver sheet flooring full width roll, completely enclosed in factory wrap, clearly marked with the manufacturer's number, type and color, production run number and manufacture date.
- C. Store materials in weathertight and dry storage facility. Protect from damage due to handling, weather, and construction operations before, during and after installation. Store sheet flooring on end with ambient temperatures maintained as recommended by manufacturer.
- D. Store sheet flooring on end.
- E. Move sheet vinyl floor coverings and installation accessories into spaces where they will be installed at least 48 hours in advance of installation.

1.7 APPLICABLE PUBLICATIONS

- A. Publications listed below form a part of this specification to extent referenced. Publications are referenced in text by basic designation only.
- B. American Society For Testing Materials (ASTM):
 - E648-09 Critical Radiant Flux of Floor-Covering Systems
Using a Radiant Energy Source.
 - E662-09 Specific Optical Density of Smoke Generated by
Solid Materials.
 - F710-08 Practice for Preparing Concrete Floors and Other
Monolithic Floors to Receive Resilient Flooring.
 - F1303-04 Sheet Vinyl Floor Covering with Backing.
 - F1869-04 Moisture Vapor Emission Rate of Concrete
Subfloor using Anhydrous Calcium Chloride
 - F1913-04 Sheet Vinyl Flooring without Backing
 - F2170-09 Determining Relative Humidity in Concrete Floor
Slabs using In-situ Probes
- C. Resilient Floor Covering Institute (RFCI):
Recommended Work Practices for Removal of Resilient Floor

Coverings. 1.8 SCHEDULING

Interior finish work such as plastering, drywall finishing, concrete, terrazzo, ceiling work, and painting work shall be complete and dry before installation. Mechanical, electrical, and other work above ceiling line shall be completed. Heating, ventilating, and air conditioning systems shall be installed and operating in order to maintain temperature and humidity requirements.

1.9 WARRANTY:

Submit written warranty, in accordance with FAR clause 52.246-21, Warranty of Construction requirements except that warranty period shall be extended to include five (5) years.

PART 2 - PRODUCTS**2.1 SHEET VINYL FLOOR COVERINGS (SV1, SV2, SV3)**

- A. Basis-of-Design: Teknoflor wood Grain Resilient Sheet flooring with backing (ASTM F 1303).
- B. Vinyl Sheet Floor Covering with Backing: ASTM F 1303
 - 1. Type (Binder Content): Type I, minimum binder content of 90 percent.
 - 2. Wear-Layer Thickness: Grade 1.
 - 3. Overall Thickness: As standard manufacturer.
 - 4. Interlayer Material: Manufacturer's standard.
 - 5. Backing Class: Class B (nonfoamed plastic).
- C. Wearing Surface: Embossed 20-mil wear layer.
- D. Sheet Width: 6 feet (1.8 m).
- E. Each color and pattern of sheet flooring shall be of same production run.
- F. Colors and Patterns as indicated on Drawings.

2.2 SHEET RUBBER FLOOR COVERINGS (SR1)

- A. Sheet Floor Coverings: Smooth face, minimum thickness nominal 2 mm (0.08 inch). Sheet flooring shall conform to ASTM F 1859 without backing.

2.3 SHEET VINYL FLOOR COVERINGS (SV4)

- A. Basis-of-Design: Mannington Commercial Inlaid Sheet Flooring.
- B. Vinyl Sheet Floor Covering: ASTM F 1303
 - 1. Type: Type 2, Grade 1, Class A.
 - 2. Wear-Layer Thickness: 0.66" (1.67 mm).
 - 3. Overall Thickness: .080" (2.03 mm).
 - 4. Sheet Width: 6 feet (1.8 m).
 - 5. Pattern Repeat: Random repeat, reverse sheet for seaming.
 - 6. Colors and Patterns: As indicated in Drawings.

2.4 WELDING ROD

Product of floor covering manufacturer in color shall match field color of sheet vinyl covering.

2.5 APPLICATION MATERIALS AND ACCESSORIES

- A. Floor and Base Adhesive (Water Resistant): Type recommended by sheet flooring material manufacturer for conditions of use.

- B. Mastic Underlayment (for concrete floors): Provide products with latex-modified Portland Cement based or blended hydrolic-cement-based formulation provided or approved by manufacturer for applications indicated. Condition to be corrected shall determine type of underlayment selected for use.
- C. Base Accessories:
 - 1. Fillet Strip: 19 mm (3/4 inch) radius fillet strip compatible with resilient sheet material.
 - 2. Cap Strip: Extruded flanged zero edge vinyl reducer strip approximately 25 mm (one inch) exposed height with 13 mm (1/2 inch) flange.

2.6 SHEET FLOORING

- A. ASTM F1303, Type II, Grade 1, except for backing requirements. Foam backed sheet flooring is not acceptable.
- B. Type I, homogenous rubber sheet.
- C. Minimum nominal thickness 2 mm (0.08 inch); 1200 mm (48 inches) minimum width.
- D. Critical Radiant Flux: 0.45 watts per [sq.cm](#) or more, Class I, per ASTM E648.
- E. Smoke density: less than 450 per ASTM E662.
- F. Color and pattern of sheet flooring of the same production run.

2.7 ADHESIVES

- A. Water resistant type recommended by the sheet flooring manufacturer for the conditions of use. VOC not to exceed 50g/L.
- B. At bed locations only, apply "epoxy adhesive"-type recommended by Sheet Flooring Material Manufacturer.

2.8 BASE CAP STRIP AND COVE STRIP

- A. Cap strip "J" shape with feathered edge flange approximately 25 mm (one inch) wide; top designed to receive sheet flooring with 13 mm (1/2 inch) flange lapping top of flooring
- B. Cove strip 70 mm (2-3/4 inch) radius.

2.9 LEVELING COMPOUND (FOR CONCRETE FLOORS)

Provide cementitious products with latex or polyvinyl acetate resins in the mix.

2.10 PRIMER (FOR CONCRETE SUBFLOORS)

As recommended by the adhesive or sheet flooring manufacturer.

2.11 EDGE STRIPS

- A. Extruded aluminum, mill finish, mechanically cleaned.
- B. 28 mm (1-1/8 inch) wide, 6 mm (1/4 inch) thick, bevel one edge to 3 mm (1/8 inch) thick.

C. Drill and counter sink edge strips for flat head screws. Space holes near ends and approximately 225 mm (9 inches) on center in between. 2.12 SEALANT

- A. As specified in Section 07 92 00, JOINT SEALANTS.
- B. Compatible with sheet flooring.

PART 3 - EXECUTION

3.1 PROJECT CONDITIONS

- A. Maintain temperature of sheet flooring above 36 °C (65 °F), for 48 hours before installation.
- B. Maintain temperature of rooms where sheet flooring work occurs above 36 °C (65 °F), for 48 hours, before installation and during installation, and as recommended by floor covering manufacturer.
- C. After installation, maintain temperature at or above 36 °C (65 °F.)
- D. Building is permanently enclosed.
- E. Wet construction in or near areas to receive sheet flooring is complete, dry and cured.

3.2 SUBFLOOR PREPARATION

- A. Concrete Subfloors: Verify that concrete slabs comply with ASTM F710.
 - 1. Installer shall examine surfaces on which resilient sheet flooring is to be installed, and shall advise Contractor, in writing, of areas which are unacceptable for installation of flooring material. Installer shall advise Contractor which methods are to be used to correct conditions that will impair proper installation. Installation shall not proceed until unsatisfactory conditions have been corrected.
 - 2. Slab substrates dry, free of curing compounds, sealers, hardeners, and other materials which would interfere with bonding of adhesive. Determine adhesion and dryness characteristics by performing bond and moisture tests recommended by Resilient Floor Covering Institute recommendations in manual RFCI-MRP.
- B. Broom or vacuum clean substrates to be covered by sheet vinyl floor coverings immediately before installation. Following cleaning, examine substrates to determine if there is visually any evidence of moisture, alkaline salts, carbonation, or dust.
- C. Primer: If recommended by flooring manufacturer, prior to application of adhesive, apply concrete slab primer in accordance with manufacturer's directions.
- D. Correct conditions which will impair proper installation, including trowel marks, pits, dents, protrusions, cracks or joints.

- E. Fill cracks, joints, depressions, and other irregularities in concrete with leveling compound.
 - 1. Do not use adhesive for filling or leveling purposes.
 - 2. Do not use leveling compound to correct imperfections which can be corrected by spot grinding.
 - 3. Trowel to smooth surface free of trowel marks, pits, dents, protrusions, cracks or joint lines.
- F. Clean floor of oil, paint, dust and deleterious substances. Leave floor dry and cured free of residue from existing curing or cleaning agents.
- G. Moisture Testing: Perform moisture and pH test as recommended by the flooring and adhesive manufacturers. Perform test locations starting on the deepest part of the concrete structure. Proceed with installation only after concrete substrates meet or exceed the manufacturer's requirements. In the absence of specific guidance from the flooring or adhesive manufacturer the following requirements are to be met:
 - 1. Perform moisture vapor emission tests in accordance with ASTM F1869. Proceed with installation only after substrates have a maximum moisture-vapor-emission rate of 1.36 kg of water/92.9 sq. m (3lb of water/1000 sq. ft.) in 24 hours.
 - 2. Perform concrete internal relative humidity testing using situ probes in accordance with ASTM F2170. Proceed with installation only after concrete reaches maximum 75 percent relative humidity level measurement.

3.3 INSTALLATION OF FLOORING

- A. Install work in strict compliance with manufacturer's instructions and approved layout drawings.
- B. Maintain uniformity of sheet floor covering direction and avoid cross seams.
- C. Arrange for a minimum number of seams and place them in inconspicuous and low traffic areas, but in no case less than 150 mm (6 inches) away from parallel joints in flooring substrates.
- D. Match edges of resilient floor coverings for color shading and pattern at seams.
- E. Where resilient sheet flooring abuts other flooring material floors shall finish level.
- F. Extend sheet floor coverings into toe spaces, door reveals, closets, and similar openings.
- G. Inform the COTR of conflicts between this section and the manufacturer's instructions or recommendations for auxiliary materials, or installation methods, before proceeding.
- H. Install sheet in full coverage adhesives.

1. Air pockets or loose edges will not be accepted.
 2. Trim sheet materials to touch in the length of intersection at pipes and vertical projections; seal joints at pipe with waterproof cement or sealant.
- I. Keep joints to a minimum; avoid small filler pieces or strips.
- J. Follow manufacturer's recommendations for seams at butt joints. Do not leave any open joints that would be readily visible from a standing position.
- K. Follow manufacturer's recommendations regarding pattern match, if applicable.
- L. Installation of Edge Strips:
1. Locate edge strips under center lines of doors unless otherwise indicated.
 2. Set aluminum strips in adhesive, anchor with lead anchors and stainless steel Phillips screws.
- M. Integral Cove Base Installation:
1. Set preformed fillet strip to receive base.
 2. Install the base with adhesive, terminate expose edge with the cap strip.
 3. Form internal and external corners to the geometric shape generated by the cove at either straight or radius corners.
 4. Heat weld joints as specified for the flooring. Seal cap strip to wall with an adhesive type sealant.
 5. Unless otherwise specified or shown where sheet flooring is scheduled, provide integral base at intersection of floor and vertical surfaces. Provide sheet flooring and base scheduled for room on floors and walls under and behind areas where casework, laboratory and pharmacy furniture and other equipment occurs, except where mounted in wall recesses.

3.4 INSTALLATION OF INTEGRAL COVERED BASE

- A. Set preformed cove to receive base. Install base material with adhesive and terminate exposed edge with cap strip. Integral base shall be 150 mm (6 inches) high.
- B. Internal and external corners shall be formed to geometric shape generated by cove at either square or radius corners.

3.5 WELDING

- A. Heat weld all joints of flooring and base using equipment and procedures recommended by flooring manufacturer.
- B. Welding shall consist of routing joint, inserting a welding rod into routed space, and terminally fusing into a homogeneous joint.

- C. Upon completion of welding, surface across joint shall finish flush, free from voids, and recessed or raised areas.
- D. Fusion of Material: Joint shall be fused a minimum of 65 percent through thickness of material, and after welding shall meet specified characteristics for flooring.

3.6 CLEANING

- A. Clean small adhesive marks during application of sheet flooring and base before adhesive sets, excessive adhesive smearing will not be accepted.
- B. Remove visible adhesive and other surface blemishes using methods and cleaner recommended by floor covering manufacturers.
- C. Clean and polish materials per flooring manufacturer's written recommendations.
- D. Sweep or vacuum floor thoroughly to remove any loose dirt, dust and other foreign materials.
- E. Do not wash floor until after period recommended by floor covering manufacturer and then prepare in accordance with manufacturer's recommendations.
- F. Upon completion, Resident Engineer shall inspect floor and base to ascertain that work was done in accordance with manufacturer's printed instructions.
- G. Perform initial maintenance according to flooring manufacturer's written recommendations.

3.7 PROTECTION:

- A. Protect installed flooring as recommended by flooring manufacturer against damage from rolling loads, other trades, or placement of fixtures and furnishings.
- B. Keep traffic off sheet flooring for 24 hours after installation. Do not allow rolling cards to be used on the floor for at least 72 hours.
- C. Where construction traffic is anticipated, cover sheet flooring with reinforced kraft paper properly secured and maintained until removal is authorized by the Resident Engineer.
- D. Where protective materials are removed and immediately prior to acceptance, repair any damage, re-clean sheet flooring, lightly re-apply polish and buff floor.

- - - E N D - - -

THIS PAGE INTENTIONALLY LEFT BLANK

**SECTION 09 68 00
CARPETING**

PART 1 - GENERAL

1.1 DESCRIPTION

Section specifies carpet, edge strips, adhesives, and other items required for complete installation.

1.2 RELATED WORK

A. Color and texture of carpet and edge strip: Section 09 06 00, SCHEDULE FOR FINISHES.

B. Resilient wall base: Section 09 65 13, RESILIENT BASE AND ACCESSORIES. **1.3 QUALITY ASSURANCE**

A. Carpet installed by mechanics certified by the Floor Covering Installation Board.

B. Certify and label the carpet that it has been tested and meets criteria of CRI IAQ Carpet Testing Program for indoor air quality.

1.4 SUBMITTALS

A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

B. Product Data:

1. Manufacturer's catalog data and printed documentation stating physical characteristics, durability, resistance to fading and flame resistance characteristics for each type of carpet material and installation accessory.

2. Manufacturer's printed installation instructions for the carpet, including preparation of installation substrate, seaming techniques and recommended adhesives and tapes.

3. Manufacturer's certificate verifying carpet containing recycled materials include percentage of recycled materials as specified.

C. Samples:

1. Carpet: "Production Quality" samples 300 x 300 mm (12 x 12 inches) of carpets, showing quality, pattern and color specified in Drawings.

2. Floor Edge Strip (Molding): 150 mm (6 inches) long of each color and type specified.

3. Base Edge Strip (Molding): 150 mm (6 inches) long of each color specified.

D. Shop Drawings: Installers layout plan showing seams and cuts for sheet carpet and carpet module.

- E. Maintenance Data: Carpet manufacturer's maintenance instructions describing recommended type of cleaning equipment and material, spotting and cleaning methods and cleaning cycles.
- F. Surplus Material: Contractor is to provide one piece of surplus field carpet (12' x 24') to the VA. Carpet shall be of same dye lot and run as field carpet used on project.

1.5 DELIVERY AND STORAGE

- A. Deliver carpet in manufacturer's original wrappings and packages clearly labeled with manufacturer's name, brand, name, size, dye lot number and related information.
- B. Deliver adhesives in containers clearly labeled with manufacturer's name, brand name, number, installation instructions, safety instructions and flash points.
- C. Store in a clean, dry, well ventilated area, protected from damage and soiling. Maintain storage space at a temperature above 16 degrees C (60 degrees F) for 2 days prior to installation.

1.6 ENVIRONMENTAL REQUIREMENTS

Areas in which carpeting is to be installed shall be maintained at a temperature above 16 degrees C (60 degrees F) for 2 days before installation, during installation and for 2 days after installation. A minimum temperature of 13 degrees C (55 degrees F) shall be maintained thereafter for the duration of the contract. Traffic or movement of furniture or equipment in carpeted area shall not be permitted for 24 hours after installation. Other work which would damage the carpet shall be completed prior to installation of carpet.

1.7 WARRANTY

Carpet and installation subject to terms of "Warranty of Construction" FAR clause 52.246-21, except that warranty period is extended to two years.

1.8 APPLICABLE PUBLICATIONS

- A. Publication listed below form a part of this specification to extent referenced. Publications are referenced in text by basic designation only.
- B. American National Standards Institute (ANSI):
ANSI/NSF 140-07Sustainable Carpet Assessment Standard
- C. American Association of Textile Chemists and Colorists (AATCC):
AATCC 16-04Colorfastness to Light
AATCC 129-05Colorfastness to Ozone in the Atmosphere under
High Humidities

AATCC 134-06 Electric Static Propensity of Carpets
 AATCC 165-99 Colorfastness to Crocking: Textile Floor
 Conerings-AATCC Crockmeter Method

D. American Society for Testing and Materials (ASTM):

ASTM D1335-05 Tuft Bind of Pile Yarn Floor Coverings
 ASTM D3278-96 (R2004) Flash Point of Liquids by Small Scale Closed-Cup
 Apparatus
 ASTM D5116-06 Determinations of Organic Emissions from Indoor
 Materials/Products
 ASTM D5252-05 Operation of the Hexapod Tumble Drum Tester
 ASTM D5417-05 Operation of the Vettermann Drum Tester
 ASTM E648-06 Critical Radiant Flux of Floor-Covering Systems
 Using a Radiant Heat Energy Source

E. The Carpet and Rug Institute (CRI):

CRI 104-02 Installation of Commercial Carpet

PART 2 - PRODUCTS

2.1 BROADLOOM CARPET (CPT1)

A. Basis-of-Design: Subject to compliance with requirements, provide the following or approved equal product.

1. Mannington Commercial, Pattern: Squareberry - Integra HP RE,
Color: as indicated on Drawings.
2. Pile Height: .143 inches (3.63 mm)
3. Pile Fiber: InVista Antron Legacy Type 6/6 etc.
4. Pile Type: Tip sheared patterned loop
5. Backing Mats: 100% synthetic and Integra HP RE with chemically welded seams for complete moisture barrier.

2.2 BROADLOOM CARPET (WOC)

A. Basis-of-Design: Subject to compliance with requirements, provide the following or approved equal product.

1. Connexus Flooring, Super Nop 52, Color: as indicated on Drawings.
2. Pile Height: 3/8" (6.78 mm)
3. Pile Fiber: 100% Asota Solution-dyed UV stabilized polypropylene.
4. Pile Type:
5. Backing Mats: EcoDi composite rubber

2.3 GENERAL PHYSICAL CHARACTERISTICS

- A. Carpet free of visual blemishes, streaks, poorly dyed areas, fuzzing of pile yarn, spots or stains and other physical and manufacturing defects.
- B. Manufacturers standard construction commercial carpet: 1. Broadloom; maximum width to minimum use

- C. Appearance Retention Rating (ARR): Carpet shall be tested and have the minimum 3.5-4.0 Severe ARR when tested in accordance with either the ASTM D 5252 (Hexapod) or ASTM D 5417 (Vettermann) test methods using the number of cycles for short and long term tests as specified.
 - D. Tuft Bind: Minimum force of 40 N (10 lb) required to pull a tuft or loop free from carpet backing. Test per ASTM D1335.
 - E. Colorfastness to Crocking: Dry and wet crocking and water bleed, comply with AATCC 165 Color Transference Chart for colors, minimum class 4 rating.
 - F. Colorfastness to Ozone: Comply with AATCC 129, minimum rating of 4 on the AATCC color transfer chart.
 - G. Delamination Strength: Minimum of 440 N/m (2.5 lb/inch) between secondary backing.
 - H. Flammability and Critical Radiant Flux Requirements:
 - 1. Test Carpet in accordance with ASTM E 648.
 - 2. Class I: Not less than 0.45 watts per square centimeter.
 - 3. Carpet in corridors, exits and Medical Facilities: Class I.
 - I. Density: Average Pile Yarn Density (APYD):
 - 1. Corridors, lobbies, entrances, common areas or multipurpose rooms, open offices, waiting areas and dining areas: Minimum APYD 6000.
 - 2. Other areas: Minimum APYD 4000.
 - J. VOC Limits: Meets SCAQMD Rule #1168.
 - K. Shall meet platinum level of ANSI/NSF 140.
 - L. Color, Texture, and Pattern: As specified in Drawings.
- 2.4 ADHESIVE AND CONCRETE PRIMER**
- A. Waterproof, resistant to cleaning solutions, steam and water, nonflammable, complies with air-quality standards as specified. Adhesives flashpoint minimum 60 degrees C (140 degrees F), complies with ASTM D 3278.
 - B. Seam Adhesives: Waterproof, non-flammable and non-staining.
- 2.5 SEAMING TAPE**
- A. Permanently resistant to carpet cleaning solutions, steam, and water.
 - B. Recommended by carpet manufacturer.
- 2.6 EDGE STRIPS (MOLDING)**
- A. As indicated on Drawings
- 2.7 LEVELING COMPOUND (FOR CONCRETE FLOORS)**
- A. Provide Portland cement bases polymer modifier with latex or polyvinyl acetate resin manufactured specifically for resurfacing and leveling concrete floors. Products containing gypsum are not acceptable.

- B. Determine the type of underlayment selected for use by condition to be corrected.

PART 3 - EXECUTION

3.1 SURFACE PREPARATION

- A. Examine surfaces on which carpeting is to be installed.
- B. Clean floor of oil, waxy films, paint, dust and deleterious substances that prevent adhesion, leave floor dry and cured, free of residue from curing or cleaning agents.
- C. Correct conditions which will impair proper installation, including trowel marks, pits, dents, protrusions, cracks or joints.
- D. Fill cracks, joints depressions, and other irregularities in concrete with leveling compound.
 - 1. Do not use adhesive for filling or leveling purposes.
 - 2. Do not use leveling compound to correct imperfections which can be corrected by spot grinding.
 - 3. Trowel to smooth surface free of trowel marks, pits, dents, protrusions, cracks or joint lines.
- E. Test new concrete subfloor prior to adhesive application for moisture and surface alkalinity per CRI 104 Section 6.3.1 or per ASTM E1907.

3.2 CARPET INSTALLTION

- A. Do not install carpet until work of other trades including painting is complete and dry.
- B. Install in accordance with CRI 104 direct glue down installation.
 - 1. Relax carpet in accordance with Section 6.4.
 - 2. Comply with indoor air quality recommendations noted in Section 6.5.
 - 3. Maintain temperature in accordance with Section 15.3.
- C. Secure carpet to subfloor of spaces with adhesive applied as recommended by carpet manufacturer.
- D. Follow carpet manufacturer's recommendations for matching pattern and texture directions.
- E. Cut openings in carpet where required for installing equipment, pipes, outlets, and penetrations.
 - 1. Bind or seal cut edge of sheet carpet and replace flanges or plates.
 - 2. Use additional adhesive to secure carpets around pipes and other vertical projections.

G. Broadloom Carpet:

1. Install per CRI 104, Section 8.
2. Lay broadloom carpet lengthwise in longest dimension of space, with minimum seams, uniformly spaced to provide a tight smooth finish, free from movement when subjected to traffic.
3. Use tape-seaming method to join sheet carpet edges. Do not leave visible seams.

3.3 EDGE STRIPS INSTALLATION

- A. Install edge strips over exposed carpet edges adjacent to uncarpeted finish flooring.
- B. Anchor metal strips to floor with suitable fasteners. Apply adhesive to edge strips, insert carpet into lip and press it down over carpet.
- C. Anchor vinyl edge strip to floor with adhesive apply adhesive to edge strip and insert carpet into lip and press lip down over carpet.

3.4 PROTECTION AND CLEANING

- A. Remove waste, fasteners and other cuttings from carpet floors.
- B. Vacuum carpet and provide suitable protection. Do not use polyethylene film.
- C. Do not permit traffic on carpeted surfaces for at least 48 hours after installation. Protect the carpet in accordance with CRI 104.
- D. Do not move furniture or equipment on unprotected carpeted surfaces.
- E. Just before final acceptance of work, remove protection and vacuum carpet clean.

3.5 SURPLUS MATERIAL

- A. Contractor is to provide on piece of surplus field carpet (12' x 24') to the VA. Carpet shall be of the same dye lot and run as field carpet used on project.

- - - E N D - - -

SECTION 09 72 16
VINYL-COATED FABRIC WALL COVERINGS

PART 1 - GENERAL

1.1 DESCRIPTION

Section specifies vinyl coated fabric wallcovering and installation.

1.2 RELATED WORK

- A. Color, pattern, type, direction of hanging and areas to receive wallcovering: As indicated on Drawings.
- B. Textile wallcoverings: Section 09 72 31, POLYPROPYLENE FABRIC WALLCOVERING.

1.3 SUBMITTALS

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Samples:
 - 1. Each type and pattern as indicated on Drawings.
 - 2. Size: 8" x 10" (203 mm x 254 mm)
- C. Manufacturer's Literature and Data:
 - 1. Primer and adhesive.
 - 2. Installation instructions.
 - 3. Maintenance instructions, including recommended materials and methods for maintaining wallcovering with precautions in use of cleaning material.

1.4 QUALITY ASSURANCE

- A. Finish one complete space with each type (color and pattern) of wallcovering showing specified colors and patterns.
- B. Use approved sample spaces as a standard for work throughout the project.

1.5 DELIVERY, STORAGE AND HANDLING

- A. Deliver in original unopened containers bearing the manufacturer's name, brand name, and product designation.
- B. Store in accordance with manufacturer's instructions.
- C. Handle to prevent damage to material.

1.6 APPLICABLE PUBLICATIONS

- A. Publications listed below form a part of this specification to the extent referenced. Publications are referenced in the text by the basic designation only.
- B. Chemical Fabrics and Film Association, Inc., (CFFA):
Document 2575-96 Vinyl Coated Fabric Wallcovering
- C. American Society for Testing and Materials (ASTM)

G21-96 (R2002)Determining Resistance of Synthetic Polymeric
Materials to Fungi

PART 2 - PRODUCTS

2.1 VINYL COATED FABRIC WALLCOVERING (WC1 AND WC2)

- A. Vinyl Wallcovering Standards: Provide mildew-resistant products complying with the following:
1. FS CCC-W-408D and CFFA-QW-101D for Type II, medium-duty products.
 2. ASTM F793 for strippable wallcoverings that qualify as Category V, Type II, Commercial Serviceability products.
 3. Basis-of-Design: Subject to compliance with requirements, provide the following or approved equal products.
 - a. Trikes Tower Wallcovering with Recore.
 3. Total weight, excluding coatings: 20 oz./lyd.
 4. Width: 53/54" (1372 mm).
 5. Backing: 100% recycled non-woven polyester backing.
 6. Repeat: None.
 7. Colors, textures, and patterns: As indicated in

Drawings. 2.2 ADHESIVE

- A. Use only water-based adhesive having volatile organic compounds not more than 50 g/l.
- B. Vermin and mildew resistant.

PART 3 - EXECUTION

3.1 JOB CONDITIONS

- A. Temperatures:
1. Do not perform work until surfaces and materials have been maintained at minimum of 60 °F. for three days before work begins.
 2. Maintain minimum temperatures of 60 °F. until adhesives are dried or cured.
- B. Lighting:
1. Do not proceed unless a minimum lighting level of 15 candlepower per square foot occurs.
 2. Measure light level at mid-height of wall.
- C. Ventilation:
1. Provide uniform continuous ventilation in space.
 2. Ventilate for a time for not less than complete drying or curing of adhesive.
- D. Protect other surfaces from damage which may be caused by this work.
- E. Remove waste from building daily.

3.2 SURFACE CONDITION

- A. Inspect surfaces to receive wallcoverings to assure that:
 - 1. Patches and repairs are completed.
 - 2. Surface are clean, smooth and prime painted.
- B. Do not proceed until discovered defects have been corrected by other trades and surfaces are ready to receive wallcovering.
- C. Carefully remove electrical outlet and switch plates, mechanical diffusers, escutcheons, registers, surface hardware, fittings and fastenings, prior to starting work.
- D. Carefully store items for reinstallation.

3.3 APPLICATION OF ADHESIVE

- A. Mix and apply adhesives in accordance with manufacturer's directions.
- B. Prevent adhesive from getting on face of wallcovering.
- C. Apply adhesive to wallcovering

back. 3.4 WALLCOVERING INSTALLATION

- A. Use wallcovering of same batch or run in an area. Use fabric rolls in consecutive numerical sequence of manufacture.
- B. Install material completely adhered, smooth, clean, without wrinkles, air pockets, gaps or overlaps.
- C. Extend wallcovering continuous behind non-built-in casework and other items which are close to but not bolted to or touching the walls.
- D. Install wallcovering before installation of resilient base. Extend wallcovering not more than 6 mm (1/4 inch) below top of resilient base.
- E. Install panels consecutively in order in which they are cut from the roll including filling spaces above or below windows, doors, or similar penetrations.
- F. Do not install horizontal seams.
- G. Except on match patterns, hang fabric by reversing alternate strips, except as recommended by the manufacturer.
- H. Cutting:
 - 1. Cut on a work table with a straight edge.
 - 2. Joints or seams that are not cut clean are unacceptable.
 - 3. Trim additional selvage to achieve a color and pattern match at seams. Overlapped seams are not allowed.
 - 4. Contractor is to double cut all seams unless specified otherwise by wall paper manufacturer.
 - 5. If double cutting on the wall is necessary, place a three inch strip of Type I wallcovering under pasted edge.
 - a. Do not cut into wall surface.

- b. After cutting, remove strip and excess adhesive from seam before proceeding to next seam.
- c. Smooth down seam in adhesive for tight bond and joint.
- I. Trim strip-matched patterns, which are not factory pre-trimmed.
- J. Inside Corners:
 - 1. Wrap wallcovering around corner.
 - 2. Do not seam within 50 mm (2 inches) of inside corners.
 - 3. Double cut seam.
- K. Outside Corners:
 - 1. Wrap wallcovering around corner.
 - 2. Do not seam within 150 mm (6 inches) of outside corners.
 - 3. Double cut seam.

3.5 PATCHING

- A. Replace surface damaged wallcovering in a space as specified for new work:
 - 1. Replace full height of surface.
 - 2. Replace from break in plane to break in plane when same batch or run is not used. Double cut seams.
 - 3. Adjoining differential colors from separate batches or runs are not acceptable.
- B. Correct loose or raised seams with adhesives to lay flat with tight bonded joint as specified for new work.

3.6 CLEANING AND INSTALLING TEMPORARY REMOVED ITEMS

- A. Remove adhesive from wallcovering as work proceeds.
- B. Remove adhesives where spilled, splashed or splattered on wallcoverings or adjacent surfaces in a manner not to damage surface from which it is removed.
- C. Reinstall previously removed electrical outlet and switch plates, mechanical diffusers, escutcheons, registers, surface hardware, fittings and fastenings.

3.7 SURPLUS MATERIAL

- A. Contractor is to provide one full roll of surplus wall coverings of each type used on the project to the VA. Wall coverings shall be of the same dye lot and match or run as that used on the project.

- - - E N D - - -

**SECTION 09 77 00
PREFINISHED PANELS**

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Decorative pre-finished wall surfacing systems and trim

1.2 RELATED SECTIONS

- A. 092900 - Gypsum Board
- B. 092216 - Non-structural Metal Framing
- C. 061000 - Rough Carpentry

1.3 REFERENCES

- A. AWI Quality Standards (Architectural Woodwork Institute)
- B. ASTM E-84 (Method of test for surface burning characteristics of building materials)
- C. BHMA (Builder's Hardware Manufacturers Associations)

1.4 SUBMITTAL

- A. Comply with Section 013323 Submittal Procedures
 - B. Provide manufacturers product data sheets for approval.
 - C. Shop Drawings: Provide Shop Drawing indicating material, dimensions, and details for construction.
 - D. Provide manufacturers recommended maintenance procedures to the owner.
- 1.5 DELIVERY, STORAGE AND HANDLING**

All products are to be packaged at the factory in heavy cardboard cartons. All shipments to the job site shall be made on wooden pallets.

PART 2 PRODUCTS

2.1 MANUFACTURER

A Basis of Design Product

- 1. Decorative interior wall surfacing system and trim shall be manufactured by Marlite, 202 Harger St., Dover, OH 44622; PH: (330) 343-6621, or approved equal.

B. Materials

- 1. All decorative interior wall surface systems shall be "PREFINISHED PANEL SYSTEM", as indicated on drawings, or approved equal.
 - a. Marlite Plank, or approved equal (WG470 Double Rabbet): Federal Specification LLL-B-805 Class 1 Finish A.B.P.A. PS 59-73. Meets ANSI and AHA Standards for pre-finishing paneling.
 - b. Wood Veneer: Awl Finish System TR-4 custom grade finish. High Density Fiberboard (HDF) core.

- c. Panels are 1/4" thick, edges are square, and sealed. Print as indicated on Finish Schedule.
- d. Grain direction (if any) shall be manufacturer's standard (typically vertical), except as requested by specifier.
- e. Size panels as indicated on

drawings. 2.2 ACCESSORIES

- A. All trim specified shall be heavy weight extruded aluminum 6063-T5 alloy prefinished at the factory.
 - 1. Trim Profiles for 1/4" thick panels
 - a. Aluminum Trim - 90° Inside Corner trim shall be Marlite's part #M451L Inside Corner, provided in 8' lengths.
 - b. Aluminum Trim - 90° Outside Corner, shall be Marlite's part #M460, provided in 8' lengths.
 - c. Aluminum Trim Division shall be Marlite's part #M465, provided in 8' lengths.
 - d. Aluminum Trim Edge shall be Marlite's part #M470, provided in 8' lengths.
 - 2. Trim Finishes
 - a. Factory finish to harmonize with Marlite Plank.
- B. Wood Molding specified shall be prefinished at the factory.
 - 1. Wood Molding Profiles for 1/4" thick panels.
 - a. Single Chair Rail shall be Marlite's part #WG477.
 - b. Base Molding shall be Marlites's part #WG1261.
 - 2. Wood Molding Finishes
 - a. Painted to match panel.
- C. Adhesives and Sealants
 - 1. Adhesive meeting ASTM Specification C557, shall be Marlite #C-375.
 - 2. Sealant shall be MS250 clear or MS251 Manite Silicone Sealant as required.

2.4 FABRICATION

- A. All Surface Systems panels, hardware and accessories shall be factory finished and ready to install. Field fabrication will be required at perimeter conditions.
- B. Panel edges must be refinished per manufacturer's instruction after field cutting, before installation.

PART 3: EXECUTION**3.1 PREPARATION**

- A. Structural walls should be finished, with building completely closed. Walls shall be thoroughly dry before starting installation. A vapor barrier should be used on exterior walls behind backing to discourage warping.
- B. Panels must be applied over a smooth, solid, flat backing such as plywood or drywall. All drywall joints should be taped and finished. Walls should be primed before installation begins.
- C. Protect existing surfaces with drop cloths.

3.2 CONDITIONING

All panels shall be allowed to equalize to the moisture and temperature in the room environment prior to installation. To ensure product performance, a temperature range of 60°-80°F and a humidity range of 35-55% must be maintained during storage, installation and product life cycle.

3.3 INSTALLATION

- A. Install all materials in strict accordance with the manufacturer's installation instructions.
- B. C-375 Marlite Construction adhesive is the adhesive recommended for installation of Prefinished Panel System. Any adhesive substitution must have the manufacturer's approval.
- C. Avoid contamination of the panel faces with adhesives, solvents or cleaners during installation.

3.4 CLEANING

- A. Clean panels, trim and hardware according to the manufacturer's recommendations.

- - - E N D - - -

THIS PAGE INTENTIONALLY LEFT BLANK

**SECTION 09 77 50
FIBERGLASS REINFORCED PANELS (FRP)**

PART 1 - GENERAL

1.1 SECTION INCLUDES

Prefinished FRP (Fiberglass Reinforced Plastic) wall panels for decorative and/or sanitary environments.

1.2 ENVIRONMENTAL CONDITIONS

Building should be fully enclosed prior to installation with sufficient heat (70°) and ventilation consistent with good working conditions for finish work.

1.3 DELIVERY AND STORAGE OF MATERIALS

Materials are to be factory packaged on strong pallets. All materials are to be stored lying flat, under cover and protected from the elements. Panels should be allowed to acclimate to room temperature (70°) for 48 hours prior to installation.

PART 2 - PRODUCTS

2.1 BASIS-OF-DESIGN

A. Manufacturer:

1. Marlite FRP panels shall be as provided by Marlite, 202 Harger Street, Dover, OH 44622, (330) 343-6621, or approved equal.

B. Materials

1. All Sanitary wall panels shall be:
 - a. Marlite® Brand FRP, or approved equal.

C. Accessories

1. All trim specified shall be extruded aluminum.
 - a. Extruded Aluminum Trim Profiles for .090" thick panels.
 1. F 550 SS Inside Corner
 2. F 561 SS Outside Corner
 3. F 565 SS Division
 4. F 570 SS Edge
2. Trim Finish
 - a. Extruded Aluminum to be Bright Anodized.

PART 3 - EXECUTION

3.1 PREPARATION

Panels must be applied over a smooth, solid, flat, clean subwall such as drywall or plywood.

3.2 CONDITIONING

Panels should be opened and allowed to acclimate for 48 hours prior to installation. Room temperature should be approximately 70° F.

3.3 INSTALLATION

- A. Install all panels in strict accordance with manufacturer's installation instructions.
- B. All moldings must provide for a minimum 1/8 inch expansion joint to insure proper installation.
- C. C-551 Marlite FRP Adhesive, or approved equal. A water-resistant, non-flammable adhesive, C-551 meets ASTM Specification C557.
- D C-375 Marlite Construction Adhesive, or approved equal. A strong, flexible, water-resistant , solvent based adhesive formulated for fast, easy application, C-375 meets ASTM Specification C557.

3.4 SEALANT

Marlite® Brand MS-251 White Silicone Sealant, or approved equal.

3.5 MAINTENANCE

Wipe down using a damp cloth and mild soap solution or cleaner. Refer to manufacturer's specific cleaning recommendations Do not use abrasive cleaners.

- - - E N D - - -

SECTION 09 91 00
PAINTING

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Section specifies field painting.
- B. Section specifies prime coats which, may be applied in shop under other sections.
- C. Painting includes shellacs, stains, varnishes, coatings specified, striping or markers, and identity markings.
- D. Contractor(s) installing the herein-mentioned system(s) shall be responsible for all required identity markings and painting of their own work.

1.2 RELATED WORK

- A. Shop prime painting of steel and ferrous metals: Divisions 5, 8, 10, 11, 12, 13, and 14 sections.

1.3 SUBMITTALS

- A. Submit in accordance with Section 321723, SAMPLES AND SHOP DRAWINGS.
- B. Manufacturer's Literature and Data:
Before work is started, or sample panels are prepared, submit manufacturer's literature, indicating brand names, product type, color, gloss level, coating composition, Federal Specification Number or manufacturers name or product number where applicable, and certificates as specified.
- C. Sample Panels:
 - 1. After painters' materials have been approved and before work is started submit sample panels showing each type of finish sheen and color specified. All paint color panels shall have each coat sprayed per manufacturers' required thickness.
 - 2. Panel to show painted color: 18 gage stainless steel Q-Panel, 74 mm by 127 mm (3 inch by 5 inch).
 - 3. Panel to show transparent finishes: Wood of same species and grain pattern as wood approved for use, 102 mm by 254 by 6 mm (4 inch by 10 inch face by 1/4 inch) thick minimum, and where both flat and edge grain will be exposed, 254 mm (10 inches) long by sufficient size, 51 by 51 mm (2 by 2 inch) minimum or actual wood member to show complete finish.
 - 4. Attach labels to panel stating the following:
 - a. Federal Specification Number or manufacturers name and product number of paints used.

- b. Product type and color.
 - c. Name of project.
 - 5. Strips showing not less than 25 mm (1 inch) wide strip of primer coat, 25 mm (1 inch) wide strip of body coat over primer coat, and 74 mm (3 inch) wide strip of finish coat over body and primer coats.
 - 6. The VA has established and retains Q-Panels of approved colors used at this facility. The contractor shall submit his Q-Panels to the VA to match approved color and finish sheen.
- D. Samples of identity markers if used.

1.4 DELIVERY, AND STORAGE

- A. Deliver materials to site in manufacturer's sealed container marked to show following:
 - 1. Name of manufacturer
 - 2. Product type
 - 3. Batch number
 - 4. Instructions for use
 - 5. Safety precautions
 - 6. Material Safety Data Sheets
- B. In addition to manufacturer's label, provide a label legibly printed as following:
 - 1. Federal Specification Number, where applicable, and name of material.
 - 2. Surface upon which material is to be applied.
 - 3. If paint or other coating, state coat types; prime, body or finish.
- C. Maintain space for storage, and handling of painting materials and equipment in a neat and orderly condition to prevent spontaneous combustion from occurring or igniting adjacent items.
- D. Store materials at site at least 24 hours before using, at a temperature between 18 and 30 °K (65 and 85 °F).

1.5 MOCK-UP PANEL

- A. Before starting application of water paint mixtures, apply paint as specified to an area, not to exceed 9 m² (100 sf), selected by COTR.
- B. Finish and texture approved by COTR will be used as a standard of quality for remainder of work.

1.6 APPLICABLE PUBLICATIONS

- A. Publications listed below form a part of this specification to the extent referenced. Publications are referenced in the text by basic designation only.

- B. AMERICAN CONFERENCE OF GOVERNMENTAL INDUSTRIAL HYGIENISTS (ACGIH):
- ACGIH TLV-BKLT-1992 ...Threshold Limit Values (TLV) for Chemical Substances and Physical Agents and Biological Exposure Indices (BEIs)
- ACGIH TLV-DOC (sixth Edition...Documentation of Threshold Limit Values and Biological Exposure Indices.
- C. Federal Specifications (Fed. Spec.):
- P-W-155C Wax Floor, Water-Emulsion
INT AMD 1
- TT-C-535B(2) Coating, Epoxy, Two Component, For Interior Use On Metal, Wood, Wallboard, Painted Surfaces, Concrete And Masonry
- TT-C-542E Coating, Polyurethane, Oil Free, Moisture Curing
- TT-C-1883ACoating, Clear, Fire Retardant, Two Component Polyurethane, Thermal Insulating (Intumescent)
- TT-E-487D(1)Enamel, Floor And Deck
- TT-E-489HEnamel, Alkyd, Gloss Low VOC Content
- TT-E-506KEnamel, Alkyd, Gloss, Tints And White (For Interior Use)
- TT-E-508CEnamel, Interior, Semi-gloss, Tints And White
- TT-E-545CPrimer, (Enamel, Undercoat Alkyd Odorless, Interior, Flat, Tints And White)
- TT-F-322DFiller, Two-Component Type, For Dents, Cracks, INT AMD 1Small-Holes And Blow-Holes
- TT-F-340CFiller, Wood, Plastic
- TT-F-1098DFiller Block, Solvent-Thinned, for Porous Surfaces (Concrete Block, Cinder Block, Stucco Etc.)
- TT-P-19D Paint Latex (Acrylic Emulsion, Exterior Wood And Masonry)
- TT-P025E(2) Primer, Coating, Exterior Undercoat For Wood, Ready-Mixed, White And Tints
- TT-P-26C(1) Paint, Interior, White, Tints And Black, Fire Retardant
- TT-P-28G Paint, Aluminum, Heat Resisting (1200 degrees F)
- TT-P-29JPaint, Latex
INT AMD 2
- TT-P-30E(1) Paint, Alkyd, Odorless, Interior, Flat, White And Tints
- TT-P-38EPaint, Aluminum (Ready-mixed)

- TT-P-59E(1) Paint, Ready Mix, International Orange (Not For Residential Use)
- TT-P-95C(1) Paint, Rubber, For Swimming Pools And Other Concrete And Masonry Surfaces
- TT-P-96D(2) Paint, Latex-Base, For Exterior Surfaces (White And Tints)
- TT-P-102E Paint, Oil (Alkyd Modified, Exterior, Low VOC)
- INT AMD 1
- TT-P-641G(1) Primer Coating, Zinc Dust-Zinc Oxide (For Galvanized Surfaces)
- TT-P-645B Primer, Paint, Zinc-Molybdate, Alkyd Type
- TT-P-650D Primer Coating, Latex Base, Interior, White (For Gypsum Wallboard, or Plaster)
- TT-P-664D Primer Coating, Alkyd, Corrosion-Inhibiting, Lead And Chromate Free, VOC-Compliant
- TT-P-791B Putty, Pure-Linseed-Oil Type (For Wood-Sash-Glazing)
- TT-P-1411A Paint, Copolymer-Resin, Cementitious (For Waterproofing Concrete and Masonry Walls)
- TT-P-1511B Paint, Latex (Gloss And Semi-gloss, Tints And White) (For Interior Use)
- TT-P-2119 Paint, Latex-Base, High Traffic Area, Flat And Eggshell Finish, (Low Luster), (For Interior Use)
- TT-S-176E(1) Sealer, Surface, Varnish Type, Floor, Wood And Cork
- TT-S-179B(1)S Sealer, Surface, Pigmented Oil, For Plaster And Wallboard
- TT-S-711CS Stain, Oil Type, Wood, Interior
- D. Commercial Item Description (CID):
- A-A-1272 Plaster, Gypsum (Spackling Compound)
- A-A-1555 Water Paint, Powder (Cementitious, White and Colors)
- A-A-2210 Filler, Wood Paste
- E. Western Wood Products Association (WWPA):
- Research Note No.312- Revised Jan 30, 1985 Painting Over Knots
- F. Steel Structures Painting Council (SSPC):
- SP 1-89 No. 1, Solvent Cleaning
- SP 2-89 No. 2, Hand Tool Cleaning
- SP 3-89 No. 3, Power Tool Cleaning

G. Military Specifications (Mil. Spec.):

MIL-P-21035B Paint, High Zinc Dust Content, Galvanizing,
Repair

H. American National Standards Institute (ANSI):

ANSI-A13.1-81 Scheme for the Identification of Piping Systems

I. American Society for Testing and Materials (ASTM):

D260-86 Boiled Linseed Oil

PART 2 - PRODUCTS

2.1 MATERIALS

A. Where manufacturers' products are specified herein, products of other manufacturers that are considered equivalent to those specified may be used provided they are approved "equal" products.

B. Paint Systems presently in use and approved at this facility are as follows:

1. Exterior Paint Systems for:

a. Metal (Light to Moderate Industrial Exposure, i.e. doors, frames, trim, louvers, handrails, etc.):

1) Primer Coat:

- a) "XIM" Water Based Adhesion Promoting Exterior Primer/Sealer, U.M.A. (Over previously painted or factory primed surfaces).
- b) "Sherwin Williams" Kem Kromik→Universal Metal Primer, B50Z Series, Rust Inhibitive, low VOC. (Over bare ferrous metal only).

2) Body and Finish Coats: "Sherwin Williams" DTM Waterborne Acrylic Semi-Gloss Coating, B66W200 Series, 100% Acrylic.

b. Metal (High Performance Industrial Exposure, i.e. Electrical and Mechanical equipment, etc.):

1) Primer Coat:

- a) "XIM" Water Based Adhesion Promoting Exterior Primer/Sealer, U.M.A. (Over previously painted or factory primed surfaces).
- b) "Sherwin Williams" Kem Kromik→Universal Metal Primer, B50Z Series, Rust Inhibitive, low VOC. (Over bare ferrous metal only).

2) Body and Finish Coats: "Sherwin Williams" Corothane→II Polyurethane Satin, B65-200 Series, 2-Component, VOC Compliant, Aliphatic Acrylic Modified Polyurethane.

2. Interior Paint Systems for:
- a. New Gypsum Board or Previously Painted Wall and Ceiling Surfaces (General Use Areas):
 - 1) Primer Coat (When required for use by this section): "Sherwin Williams" PrepRite→ProBlock→Interior/Exterior Latex Primer/Sealer, B51W20.
 - 2) Body and Finish Coats: "Sherwin Williams" Harmony™ Low Odor Interior Latex Semi-Gloss Enamel, B10W951, Vinyl Acrylic. Finish (units @ 60°): 35-45.
 - b. New Gypsum Board or Previously Painted Wall and Ceiling Surfaces (High Scrubbing and Chemical Exposed Areas - Rooms; 112:
 - 1) Primer Coat (When required for use by this section): "Sherwin Williams" PrepRite→ProBlock→Interior/Exterior Latex Primer/Sealer, B51W20.
 - 2) Body and Finish Coats: "Sherwin Williams" Hi-Bild Water Based Catalyzed Epoxy. Finish (units @ 60°): 35-45.
 - c. Wood Trim Work (Painted):
 - 1) Primer Coat: "Sherwin Williams" PrepRite→ProBlock→Interior/Exterior Latex Primer/Sealer, B51W20.
 - 2) Body and Finish Coats: "Sherwin Williams" ProClassic→Waterborne Acrylic Semi-Gloss Enamel, B31W51. Finish (units @ 60°): 35-45.
 - d. Wood Trim Work (Stained and Non-stained):
 - 1) Stain (When required for use by this section): Type and color required to match adjacent work.
 - 2) Body and Finish Coats: "Minwax" Polyacrylic Water Based Varnish, Satin Finish.
 - e. Metal (General Purpose unless otherwise specified, i.e. doors, frames, trim, ceiling fan coil covers, TV brackets, handrails, furniture, lockers, wall and ceiling expansion joint covers, electrical panel covers, exposed piping, etc.):
 - 1) Primer Coat:
 - a) "XIM" Water Based Adhesion Promoting Exterior Primer/Sealer, U.M.A. (Over previously painted or factory primed surfaces).
 - b) "Sherwin Williams" Kem Kromik→Universal Metal Primer, B50Z Series, Rust Inhibitive, low VOC. (Over bare ferrous metal only).

2) Body and Finish Coats: "Sherwin Williams"

ProClassic→Waterborne Acrylic Semi-Gloss Enamel, B31W51.

Finish (units @

60°): 35-45.

3) Floor Coating: "Sherwin Williams" H&C Concrete and Masonry Waterproofing Sealer. C. Additional product information:

1. Epoxy Coating: (EC) Fed. Spec. TT-C-535.
2. Polyurethane Varnish: (PV) Fed. Spec. TT-C-542, use Type II, Class A (Clear) for interior surfaces.
3. Enamel Undercoat and Primer: Fed. Spec. TT-E-545.
4. Metal Filler: Fed. Spec. TT-F-322, Type I or II or single component filler meeting the same requirements.
5. Concrete Masonry Unit Filler: Fed Spec. TT-F-1098.
6. Aluminum Paint (AP): Fed. Spec. TT-P-38.
7. Latex Primer: Fed. Spec. TT-P-650.
8. Ferrous Metal Primer: Fed. Spec. TT-P-664.
9. Latex Gloss (GL) and Semi-Gloss: (SG): Fed. Spec. TT-P-1511.
10. Latex Flat (LF) and Low Luster (LL): Fed. Spec. TT-P-2119.
11. Gypsum Board and Gypsum Plaster Sealer: Fed. Spec. TT-S-179.
12. Wood Stain: Fed. Spec. TT-S-711.
13. Spackling Compound: CID A-A-1272.
14. Water Paint: CID A-A-1555.
15. Filler Wood Paste: CID A-A-2210.
16. Knot Sealer: WWPA Research Note 3.12, Formula WP-578 as follows.

Materials	<u>Parts By Weight</u>
Bakelite Varnish BKS - 2710, 60 percent solids	5.0
Polyvinyl butyl resin	0.5
Ethyl Alcohol 95 percent (completely denatured)	9.5
17. Liquid Acrylic Resin: Special formulation of acrylic polymers and modifiers compatible with water paint, CID A-A-1555, and designed for use as an additive for water paint mix increasing adhesion and mechanical properties.
18. Wood Sealer: Polyurethane varnish (PV) thinned with thinner recommended by manufacturer at rate of about one part of thinner to four parts of varnish.
19. Boiled Linseed Oil: ASTM D260.
20. Plastic Tape:
 - a. Pigmented vinyl plastic film in colors as specified in Section, 09050 or specified.

- b. Pressure sensitive adhesive back.
- c. Widths as shown.

21. Identity markers options:

- a. Pressure sensitive vinyl markers.
- b. Snap-on coil plastic markers

2.2 PAINT PROPERTIES

- A. Use ready-mixed (including colors), except two component polyesters, paints having metallic powders packaged separately and paints requiring specified additives.
- B. Materials finely ground, uniform in consistency and readily dispersed to form a smooth and homogeneous fluid.
- C. Where no requirements are given in the referenced specifications for primers, use primers with pigment and vehicle, compatible with substrate and finish coats specified.

2.3 REGULATORY REQUIREMENTS

- A. Paint materials shall conform to the restrictions of the local Environmental and Toxic Control jurisdiction.
 - 1. Volatile Organic Compounds (VOC): VOC content of paint materials shall not exceed local, state or district requirements.
 - 2. Lead-Base Paint:
 - a. Comply with Section 410 of the Lead-Based Paint Poisoning Prevention Act, as amended, and with implementing regulations promulgated by Secretary of Housing and Urban Development.
 - b. Regulations concerning prohibition against use of lead-based paint in federal and federally assisted construction, or rehabilitation of residential structures are set forth in Subpart F, Title 24, Code of Federal Regulations, Department of Housing and Urban Development.
 - 3. Asbestos: Materials shall not contain asbestos.
 - 4. Chromate, Cadmium, Mercury, Silica: Materials shall not contain zinc-chromate, strontium-chromate, Cadmium, mercury or mercury compounds or silica sand.
 - 5. Human Carcinogens: Materials shall not contain any of the ACGIH-BKLT and ACGHI-DOC confirmed or suspected human carcinogens.

PART 3 - EXECUTION

3.1 JOB CONDITIONS

- A. Safety: Observe required safety regulations and manufacturer's warning and instructions for storage, handling and application of painting materials.

1. Take necessary precautions to protect personnel and property from hazards due to falls, injuries, toxic fumes, fire, explosion, or other harm.
2. Deposit soiled cleaning rags and waste materials in metal containers approved for that purpose. Dispose of such items off the site at end of each day's work.

B. Atmospheric and Surface Conditions:

1. Do no exterior or interior painting in foggy, damp, or rainy weather. When building is completely enclosed, interior work may be painted.
2. Paint exterior and interior surfaces when ambient temperature is between 10 and 32 degrees C (50 and 90 degrees F), except when otherwise designated in manufacturer's printed instructions. Maintain interior temperatures until paint dries hard.
3. Do no exterior painting when it is windy and dusty.
4. Do no painting in direct sunlight or on surfaces, which will soon be warmed by the sun.
5. Apply only on clean, dry, and frost free surfaces except as follows:
 - a. Apply water thinner acrylic and cementitious paints to damp (not wet) surfaces where allowed by the manufacturer's printed instructions.
 - b. Dampened with a fine mist of water on hot dry days concrete and masonry surfaces to which water thinned acrylic and cementitious paints are applied to prevent excessive suction and to cool surface.
6. Varnishing:
 - a. Apply in clean areas and in still air.
 - b. Before varnishing vacuum and dust area.
 - c. Immediately before varnishing wipe down surfaces with a tack

rag. 3.2 SURFACE PREPARATION

- A. Method of surface preparation is optional, provided results of finish painting produce solid even color and texture specified with no overlays.
- B. General:
 1. Remove prefinished items not to be painted such as lighting fixtures, cover plates, escutcheon plates, surface hardware and trim, fittings and fastenings, mechanical diffusers and covers, and similar items for reinstallation after paint is dried.
 2. Remove items for reinstallation and complete painting of such items and adjacent areas when item or adjacent surface is not accessible or finish is different.

3. See other sections of specifications for specified surface conditions and prime coat.
4. Clean surfaces for painting with materials and methods compatible with substrate and specified finish. Remove any residue remaining from cleaning agents used. Do not use solvents, acid, or steam on concrete and masonry.

C. Wood:

1. Sand to a smooth even surface and then dust off.
2. Sand surfaces showing raised grain smooth between each coat.
3. Wipe surface with a tack rag prior to applying finish.
4. Surface painted with an opaque finish:
 - a. Coat knots, sap and pitch streaks with knot sealer before applying paint.
 - b. Apply two coats of knot sealer over knots.
5. After application of prime or first coat of stain, fill cracks, nail and screw holes, depressions and similar defects with plastic wood or putty compound. Use plastic wood for transparent finish, to match wood. Sand to make smooth and finish flush with adjacent surface.
6. Before applying finish coat, reapply plastic wood or putty compound if required, and sand surface to remove surface blemishes. Finish flush with adjacent surfaces.

D. Zinc-Coated (Galvanized) Metal, Zinc, Aluminum, Copper and Copper Alloys Surfaces Specified Painted:

1. Clean surfaces to remove grease, oil and other deterrents to paint adhesion, with toluene, xylene or similar solvents in accordance with SSPC-SP 1.
2. Spot coat abraded and damaged areas of zinc-coating which expose base metal, using zinc rich paint MIL Spec MIL -P-21035, on hot-dip zinc-coated items and spot prime with zinc dust primer, Fed Spec. TT-P641.

E. Gypsum Plaster and Gypsum Board:

1. Remove efflorescence, loose and chalking plaster or finishing materials.
2. Remove dust, dirt, and other deterrents to paint adhesion.
3. Fill holes, cracks, and other depressions with spackling compound CID-A-A-1555 finished flush with adjacent surface, with texture to match texture of adjacent surface. Patch holes over 25 mm (1-inch) in diameter as specified in Section for plaster or gypsum board.

3.3 PAINT PREPARATION

- A. Thoroughly mix painting materials to ensure uniformity of color, complete dispersion of pigment and uniform composition.
- B. Do not thin unless necessary for application and when finish paint is used for body and prime coats. Use materials and quantities for thinning as specified in manufacturers printed instructions.
- C. Remove paint skins, then strain paint through commercial paint strainer to remove lumps and other particles.
- D. Mix two component and two-part paint and those requiring additives in such a manner as to uniformly blend as specified in manufacturers printed instructions unless specified otherwise.
- E. For tinting required to produce exact shades specified, use color pigment recommended by the paint manufacturer.

3.4 APPLICATION

- A. Start of surface preparation or painting will be construed as acceptance of the surface as satisfactory for the application of materials.
- B. Unless otherwise specified, apply paint in three coats; prime, body, and finish. When two coats applied to prime coat is the same, first coat applied over primer is body coat and second coat is finish coat.
- C. Apply each coat evenly and cover substrate completely.
- D. Allow not less than 24 hours between application of succeeding coats, except as allowed by manufacturer's printed instructions, and approved by COTR.
- E. Finish surfaces to show solid even color, free from runs, lumps, brushmarks, laps, holidays, or other defects.
- F. Apply by brush, roller or spray, except as otherwise specified.
- G. Do not spray paint in existing occupied buildings or spaces unless approved by COTR, except in spaces sealed from existing occupied spaces.
 - 1. Apply painting materials specifically required by manufacturer to be applied by spraying,
 - 2. In areas, where paint is applied by spray, mask or enclose with polyethylene, or similar air tight material with edges and seams continuously sealed including items specified in WORK NOT PAINTED, motors, controls, telephone, and electrical equipment, fronts of sterilizes and other recessed equipment and similar prefinished items.
- H. Do not paint in closed position operable items such as access doors and panels, window sashes, overhead doors, and similar items except overhead roll-up doors and shutters.

3.5 PRIME PAINTING

- A. After surface preparation prime surfaces before application of body and finish coats, except as otherwise specified.
- B. Spot prime and apply body coat to damaged and abraded painted surfaces before applying succeeding coats.
- C. Shop applied prime coats shall comply with requirements of this section.
- D. Additional field applied prime coats over factory applied prime coats are required and shall comply with requirements of this section.
- E. Prime rebates for stop and face glazing of wood, and for face glazing of steel.
- F. Apply prime coat in same manner as body and finish coats.
- G. Wood and Wood Particleboard:
 - 1. Use same kind of primer specified for exposed face surface.
 - a. Exterior wood: Wood oil base primer except where wood stain is scheduled.
 - b. Interior wood except for transparent finish: Enamel primer, thinned if recommended by manufacturer.
 - c. Transparent finishes as specified under Transparent Finishes Wood Except Floors and Finish for Wood Floors.
 - 2. Apply two coats of primer or sealer to surfaces of wood doors, including top and bottom edges, which are cut for fitting or for other reason.
 - 3. Apply one coat of primer as soon as delivered to site to surfaces of unfinished woodwork, except concealed surfaces of shop fabricated or assembled millwork and surfaces specified to have varnish, stain or natural finish.
 - 4. Back prime and seal ends of exterior woodwork, and edges of exterior plywood specified to be finished.
 - 5. Apply fire retardant paint to wood for fire retardant finish.
- H. Metals except boilers, incinerator stacks, and engine exhaust pipes:
 - 1. Steel and iron: Ferrous metal primer. Use epoxy coating where finish of epoxy coating is specified.
 - 2. Zinc-coated steel and iron: Zinc dust primer.
 - 3. Aluminum scheduled to be painted: Zinc molybdate primer.
 - 4. Terne metal: Ferrous metal primer.
 - 5. Copper and copper alloys scheduled to be painted: Zinc molybdate primer.
 - 6. Machinery not factory finished: Enamel, Alkyd, Gloss Low VOC content.
 - 7. Asphalt coated metal: Aluminum paint.

8. Metal over 94 degrees C. (200 degrees F), Boilers, Incinerator Stacks, and Engine Exhaust Pipes: Heat Resistant Paint, 650 degrees C (1200 degrees F).

I. Gypsum Board and Hardboard:

1. Surfaces scheduled to have acrylic emulsion or latex emulsion finish: Use acrylic emulsion or latex emulsion respectively.
2. Surfaces scheduled to receive vinyl coated fabric wallcovering: Use enamel body coat and primer.
3. Use epoxy coating for surfaces scheduled to receive epoxy finish.

J. Concrete Floors and Base:

1. Concrete Floor Sealer.

3.6 EXTERIOR FINISHES

A. Apply following finish coats as specified.

B. Steel and Ferrous Metal, Including Tern.

1. Two coats, one body and one finish coat, on exposed surfaces, except on surfaces over 94 degrees C (200 degrees F).
2. One coat of heat resistant paint on surfaces over 94 degrees K (200 degrees F) and on surfaces of boiler, incinerator, stacks, and engine exhaust pipes.

3.7 INTERIOR FINISHES

A. Apply two coats of paint, one body and one finish coat by brush and roller, over prime coat on all surfaces, unless specified otherwise.

B. Apply two coats of paint, one body and one finish coat by spray, over prime coat as follows:

1. H.M. Doors
2. H.M. Door frames.
3. Electrical panel covers.

C. Omit body and finish coats on surfaces concealed after installation except electrical conduit containing conductors over 600 volts.

D. Wood:

1. Sanding:

- a. Use 220 grit sandpaper.
- b. Sand Sealers and varnish between coats.
- c. Sand enough to scarify surface to assure good adhesion of subsequent coats, to level roughly applied sealer and varnish, and to knock off "whiskers" of any raised grain as well as dust particles.

2. Sealers:

- a. Apply sealers specified except sealer may be omitted where pigmented, penetrating, or wiping stains containing resins are used.
- b. Allow manufacturer's recommended drying time before sanding, but not less than 24 hours or 36 hours in damp or muggy weather.
- c. Sand as specified.

3. Transparent Finishes on Wood Except

Floors. a. Natural Finish:

- 1) One coat of sealer.
- 2) Two coats of satin finish.

b. Stain Finish:

- 1) One coat of stain.
- 2) Use wood stain of type and color required to achieve finish specified. Do not use varnish type stains.
- 3) One coat of sealer.
- 4) Two coats of satin finish.

c. Clear Fire Retardant Coating (FC) where scheduled: Two coats. **3.8 PAINT COLOR**

- A. Color and gloss of finish coats is as specified in this section and on the drawings.
- B. For additional requirements regarding color see Articles, REFINISHING EXISTING PAINTED SURFACE and MECHANICAL AND ELECTRICAL FIELD PAINTING SCHEDULE.
- C. Coat Colors:
 1. Color of priming coat: Lighter than body coat.
 2. Color of body coat: Lighter than finish coat.
 3. Color prime and body coats to not show through the finish coat and to mask surface imperfections or contrasts.
- D. Painting, Caulking, Closures, and Fillers Adjacent to Casework:
 1. Paint to match color of casework where casework has a paint finish.
 2. Paint to match color of wall where casework is stainless steel, plastic laminate, or varnished wood.

3.9 MECHANICAL AND ELECTRICAL WORK FIELD PAINTING SCHEDULE

- A. Field painting of mechanical and electrical work, consists of cleaning, touching-up abraded shop prime coats, and applying prime, body and finish coats to materials and equipment if not factory finished in space scheduled to be finished.
- B. In spaces not scheduled to be finish painted, paint as specified under paragraph G, colors.
- C. Paint various systems specified in Divisions 2, 15, and 16.
- D. Paint after tests have been completed.
- E. Finish painting of mechanical and electrical equipment is not required when located in interstitial spaces, above suspended ceilings, in concealed areas such as pipe and electric closets, pipe basements, pipe tunnels, trenches, attics, roof spaces, shafts and furred spaces except on electrical conduit containing feeders 600 volts or more, unless otherwise noted.
- F. Omit field painting of items specified in Subparagraph, WORK NOT PAINTED.

G. Color:

1. Paint items having no color specified to match surrounding surfaces.
2. Paint colors as specified except for following:
 - a. White Exterior unfinished surfaces of enameled plumbing fixtures. Insulation coverings on breeching and uptake inside boiler house, drums and drumheads, oil heaters, condensate tanks and condensate piping.
 - b. Gray Heating, ventilating, air conditioning and refrigeration equipment (except as required to match surrounding surfaces). Water and sewage treatment equipment and sewage ejection equipment.
 - c. Aluminum Color Ferrous metal on outside of boilers and in connection with boiler settings including supporting doors and door frames and fuel oil burning equipment. Steam generation system (bare piping, fittings, hangers, supports, valves, traps and miscellaneous ironwork in contact with pipe).
 - d. Federal Safety Red Exposed fire protection piping hydrants, post indicators, electrical conduits containing fire alarm control wiring, and fire alarm equipment.
 - e. Federal Safety Orange Entire lengths of electrical conduits containing feeders 600 volts or more.
 - f. Color To Match Brickwork Sheet metal covering on breeching outside of exterior wall of boiler house.

H. Apply paint on properly prepared and primed surface as specified under Articles EXTERIOR FINISHES and INTERIOR FINISHES, unless otherwise specified:

1. Exterior Locations:
 - a. Paint vent and exhaust pipes, normal temperature, under 94 degrees K (200 degrees F), roof drains, fire hydrants, post indicators, yard hydrants, exposed piping, galvanized and zinc-copper alloy metal, and similar items.
 - b. Apply one coat of Heat Resistant paint, 650 degrees K (1200 degrees F) to incinerator stacks, boiler stacks, and engine generator exhaust.
2. Interior Locations:
 - a. Paint the following items when exposed to view:
 - 1) Metal under 94 degrees K (200 degrees F) of items such as bare piping, fittings, hangers and supports.

- 2) Equipment and systems such as hinged covers and frames for control cabinets and boxes, cast-iron radiators, electric conduits, and panel boards.
 - 3) Heating, ventilating, air conditioning, plumbing equipment, and machinery having shop prime coat and not factory finished.
 - 4) Paint existing exposed equipment and systems such as heating, ventilating, air conditioning, plumbing equipment, exposed piping and conduits, and electrical panel board covers as shown on the drawings to be painted.
3. Other exposed locations:
- a. Metal surfaces, except aluminum, of cooling towers exposed to view, including connected pipes, rails, ladders: Two coats of aluminum paint.
 - b. Cloth jackets of insulation of ducts and pipes in connection with plumbing, air conditioning, ventilating refrigeration and heating systems: Two coats of acrylic emulsion.

3.10 BUILDING AND STRUCTURAL WORK FIELD PAINTING

- A. Painting and finishing of interior and exterior work except as specified under Paragraph Work Not Painted.
1. Painting and finishing of new and existing work including colors and gloss of finish selected is as specified and shown on the drawings
 2. Painting of ferrous metal and galvanized metal.
 3. Painting of wood with fire retardant paint exposed in attics, when used as mechanical equipment space except shingles.
 4. Identity painting and safety painting.
- B. Building and Structural Work Not Painted:
1. Prefinished items:
 - a. Casework, doors, elevator entrances and cabs, metal panels, wall covering, and similar items specified factory finished under other sections.
 - b. Factory finished equipment and pre-engineered metal building components such as metal roof and wall panels.
 2. Finished surfaces:
 - a. Hardware except ferrous metal.
 - b. Anodized aluminum, stainless steel, chromium plating, copper, and brass, except as otherwise specified.
 - c. Signs, fixtures, and other similar items integrally finished.
 3. Concealed surfaces:

- a. Inside dumbwaiter, elevator and duct shafts, interstitial spaces, pipe basements, crawl spaces, pipe tunnels, above ceilings, attics, except as otherwise specified.
 - b. Inside walls or other spaces behind access doors or panels.
 - c. Surfaces concealed behind permanently installed casework and equipment.
4. Moving and operating parts:
 - a. Shafts, chains, gears, mechanical and electrical operators, linkages, and sprinkler heads, and sensing devices.
 - b. Tracks for overhead or coiling doors, shutters, and grilles.
 5. Labels:
 - a. Code required label, such as Underwriters Laboratories Inc., Inchcape Testing Services, Inc., or Factory Mutual Research Corporation.
 - b. Identification plates, instruction plates, performance rating, and nomenclature.
 6. Galvanized metal:
 - a. Exterior chain link fence and gates, corrugated metal areaways, and gratings.
 - b. Gas Storage Racks.
 - c. Except where specifically specified to be painted.
 7. Metal safety treads and nosings.
 8. Gaskets.
 9. Concrete curbs, gutters, pavements, retaining walls, exterior exposed foundation walls, and interior walls in pipe basements.
 10. Face brick.
 11. Structural steel encased in concrete, masonry, or other enclosure.
 12. Structural steel to receive sprayed-on fire proofing.
 13. Ceilings, walls, columns in interstitial spaces.
 14. Ceilings, walls, and columns in pipe basements.
 15. Wood Shingles.

3.12 IDENTITY PAINTING SCHEDULE

- A. Identify designated service in accordance with ANSI A13.1, unless specified otherwise. Apply identity markings and painting as specified on exposed piping, piping above removable ceilings, piping in accessible pipe spaces, interstitial spaces, and piping behind access panels.
 1. Legend may be identity marker options or stencil applied painted on.
 2. Apply legends adjacent to changes in direction, on branches, where pipes pass through walls or floors, adjacent to operating accessories

such as valves, regulators, strainers and cleanouts a minimum of 12,200 mm (40 feet) apart on straight runs of piping. Identification next to plumbing fixtures is not required.

3. Locate legends clearly visible from operating position.
4. Use arrow to indicate direction of flow.
5. Identify pipe contents with sufficient additional details such as temperature, pressure, and contents to identify possible hazard. Insert working pressure shown on drawings where asterisk appears for High, Medium, and Low Pressure designations as follows:
 - a. High Pressure - 414 Kpa (60 psi) and above
 - b. Medium Pressure - 104 to 413 Kpa (15 to 59 psi).
 - c. Low Pressure - 103 Kpa (14 psi) and below
 - d. Add Fuel oil grade numbers.
6. Legend name in full or in abbreviated form as follows:

PIPING	COLOR OF EXPOSED PIPING	COLOR OF BACKGROUND	COLOR OF LETTERS	LEGEND ABBREVIATIONS
Blow-off	-	Yellow	Black	Blow-off
Boiler Feedwater	-	Yellow	Black	Blr.Feed
A/C Condenser	-	Green	White	A/C Cond. W.
Water Supply	-	Green	White	Sup.
Chilled Water Supply	-	Green	White	Ch. W. Sup.
Chilled Water Return	-	Green	White	Ch. W. Ret.
Shop Compressed Air	-	Yellow	Black	S. Air
Air-Instrument Controls	-	Green	White	Air-Inst. Cont.
Drain Line	-	Green	White	Drain
Emergency Shower	-	Green	White	Emg. Shower
High Pressure Steam	-	Yellow	Black	H.P. Stm.____*
High Pressure Condensate Return	-	Yellow	Black	H.P. Ret.____*
Medium Pressure Steam	-	Yellow	Black	M.P. Stm.____*
Medium Pressure Condensate Return	-	Yellow	Black	M.P. Ret.____*
Low Pressure Steam	-	Yellow	Black	L.P. Stm.____*
Low Pressure Condensate Return	-	Yellow	Black	L.P. Ret.____*
High Temperature Water Supply	-	Yellow	Black	H. Temp W. Sup.
High Temperature Water Return	-	Yellow	Black	H. Temp W. Ret.
Hot Water Heating Supply	-	Yellow	Black	H. W. Htg. Sup.

Hot Water Heating Return	-	Yellow	Black	H. W. Htg. Ret.
Gravity Condensate Return	-	Yellow	Black	Gravity Cond. Ret.
Pumped Condensate Return	-	Yellow	Black	Pumped Cond. Ret.
Vacuum Condensate Return	-	Yellow	Black	Vac. Cond. Ret.
Fuel Oil - Grade Boiler Water	-	Green	White	Fuel Oil-Grade___*
Sampling Chemical Feed	-	Yellow	Black	Sample Chem.
Continuous Blow Down	-	Yellow	Black	Cont. B. D.
Condensate Pumped Pump	-	Yellow	Black	Cond. - Pump
Recirculating Vent Line	-	Yellow	Black	Pump-Recirc. Vent
Alkali Bleach Detergent	-	Yellow	Black	Alk Bleach Det.
Liquid Supply Reuse Water	-	Yellow	Black	Liq. Sup. Reuse Wtr.
Cold Water (Domestic)	White	Green	White	C. W. Dom.
Hot Water (Domestic)- Supply	White	Yellow	Black	H. W. Dom.
Return	White	Yellow	Black	H. W. Dom. Ret.
Tempered Water	White	Yellow	Black	Temp. Wtr.
Reagent Grade Water	-	Green	White	RG
Reverse Osmosis	-	Green	White	RO
Sanitary Waste	-	Green	White	San. Waste
Sanitary Vent	-	Green	White	San. Vent
Storm Drainage Pump Drainage	-	Green	White	St. Drain Pump Drain.
Chemical Resistant Pipe-Waste	-	Yellow	Black	Acid Waste
Vent	-	Yellow	Black	Acid Vent
Atmospheric Vent	-	Green	White	ATV
Silver Recovery	-	Green	White	Sil. Rec.
Oral Evacuation	-	Green	White	Oral Evac.
Fuel Gas	-	Yellow	Black	Gas
Fire Protection Water-				
Sprinkler Standpipe	Red	Red	White	Auto.- Sprinkler Stand.
Sprinkler	Red	Red	White	Drain
Fire Protection Electrical-Box &				Fire Alarm

- | Cover | Red | Red | White | System |
|-------|-----|-----|-------|--------|
|-------|-----|-----|-------|--------|
7. Electrical Conduits containing feeders over 600 volts, paint legends using 50 mm (2 inch) high black numbers and letters, showing the voltage class rating. Provide legends where conduits pass through walls and floors and at maximum 6100 mm (20 foot) intervals in between. Use labels with yellow background with black border and words Danger High Voltage Glass, 5000.
 8. See Sections for methods of identification, legends, and abbreviations of the following:
 - a. Regular compressed air lines: Section 15319, COMPRESSED AIR SYSTEMS, SHOP AND LAUNDRY.
 - b. Dental compressed air lines: Section, 15481, DENTAL COMPRESSED AIR.
 - c. Laboratory gas and vacuum lines: Section 15488, LABORATORY (NONFLAMMABLE) GAS AND VACUUM SYSTEMS.
 - d. Oral evacuation lines: Section 15489, ORAL EVACUATION SYSTEM.
 - e. Medical Gases and vacuum lines: Section 15491, MEDICAL GAS AND VACUUM SYSTEMS.
 - f. Conduits containing high voltage feeders over 600 volts: Section 16111, CONDUIT SYSTEMS.
- B. Fire and Smoke Partitions:
1. Identify partitions above ceilings on both sides of partitions except within shafts in letters not less than 64 mm (2 1/2 inches) high.
 2. Stenciled message: "SMOKE PARTITION" or, "FIRE PARTITION" as applicable.
 3. Locate not more than 6100 mm (20 feet) on center on corridor sides of partitions, and with a least one message per room on room side of partition.
 4. Use semi-gloss paint of color that contrasts with color of substrate.
- C. Identify columns in pipe basements and interstitial space:
1. Apply stenciled number and letters to correspond with grid numbering and lettering shown.
 2. Paint numbers and letters 100 mm (4 inches) high, locate 450 mm (18 inches) below overhead structural slab.
 3. Apply on four sides of interior columns and on inside face only of exterior wall columns.
 4. Color:
 - a. Use black on concrete columns.
 - b. Use white or contrasting color on steel columns.

3.13 PROTECTION CLEAN UP, AND TOUCH-UP

- A. Protect work from paint droppings and spattering by use of masking, drop cloths, removal of items or by other approved methods.
- B. Upon completion, clean paint from hardware, glass and other surfaces and items not required to be painted of paint drops or smears.
- C. Before final inspection, touch-up or refinished in a manner to produce solid even color and finish texture, free from defects in work which was damaged or discolored.

- - - E N D - - -

**SECTION 10 11 13
MARKERBOARDS**

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This section specifies markerboards and related items.
- B. Boards may be either factory or field assembled.
- C. Where shown, assemble markerboards with tackboards into a single unit.

1.2 RELATED WORK

- A. Section 10 11 23, TACKBOARDS.

1.3 QUALITY ASSURANCE

Boards shall be the products of one manufacturer.

1.4 SUBMITTALS

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA AND SAMPLES.
- B. Shop Drawings: Identifying all parts by name and material and showing design, construction, installation, anchorage and relation to adjacent construction.
- C. Manufacturer's Literature and Data: 1. Markerboard
- D. Samples:
 - 1. Markerboard writing surface, 300 by 300 mm (six by six inches), each color, mounted on backing.
 - 2. Each accessory (after approval, may be used in the

work). 1.5 APPLICABLE PUBLICATIONS

- A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.
- B. National Association of Architectural Metal Manufacturers (NAAMM):
 - AMP 500 Series Metal Finishes Manual
 - AMP 501 Finishes for Aluminum
- C. American National Standards (ANSI):
 - Z97.1-04 Safety Glazing Materials Used in Buildings - Safety Performance Specifications and Methods of Test
- D. American Society for Testing and Materials (ASTM):
 - B221/B221M-06 Aluminum and Aluminum Alloy Extruded Bars, Rods, Wire, Shapes and Tubes
 - C1036-06 Flat Glass

C1048-04 Heat-Treated Flat Glass-Kind HS, Kind FT
Coated

and Uncoated Glass

F104-03 Nonmetallic Gasket Materials

E. Composite Panel Association (CPA):

A208.1-06 Particleboard

A135.4-04 Basic Hardboard

PART 2 - PRODUCTS

2.1 MARKERBOARD

- A. Porcelain-Enamel Markerboards: Balanced, high-pressure, factory-laminated markerboard assembly of three-ply construction consisting of backing sheet. Core material and 0.021-inch (0.53 mm) porcelain-enamel face with low gloss finish.

2.2 FABRICATION

A. Materials:

1. Aluminum, extruded: ASTM B221.
2. Backing: Hardboard, AHBA A135.4 or particleboard, CPA A208.1.

B. Components:

1. Writing Surface: Factory assembly consisting of face sheet of 24 gauge sheet steel with porcelain enamel board texture finish conforming to PEI S-100, laminated to a hardboard or particleboard backing, 9 mm to 13 mm (3/8 to 1/2-inch) thick, and a 0.13 mm (0.005-inch) thick aluminum foil back sheet laminated to back-face.
2. Frames (Trim): Extruded aluminum, 1.5 mm (0.060-inch) thick, snap-on type, approximate face width 44 mm (1-3/4 inch), depth and configuration as required to return to wall and engage clips.
3. Trough: Extruded aluminum, 2.34 mm (0.092-inch) thick, not less than 75 mm (3-inch) projection from writing surface with grooved top surface, closed ends and return to wall surface at underside. Design to be snap-on type with concealed fasteners.
4. Mullions: Snap-on type, same material and face width as frames, designed to finish flush with frame.
5. Grounds: Continuous zinc-coated (galvanized) steel or extruded aluminum members designed to support the board writing surface and clips for snap-on frames and chalk tray.
6. Clips: Manufacturer's standard as required to support frame, mullions, and trough.

C. Boards 3660 mm (12 feet) or less in length shall be in one piece.

D. Finish exposed aluminum surfaces as follows:

1. AA 45 chemically etched medium matte, with clear anodic coating Class II Architectural, 0.4 mils thick (AA-M12C22A32).

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

- A. Install units in accordance with the manufacturer's installation instructions, use concealed fasteners.
- B. Inspect surfaces and related construction to receive units. Partitions shall have reinforcing to receive fasteners. Verify type and placement of reinforcement.
- C. Do not proceed with the installation until reinforcement is in place and surfaces are flat.
- D. Assemble units as specified by the manufacturer.

3.2 INSTALLATION OF CHALKBOARD AND MARKERBOARD

- A. Mount board with adhesive and blocking pads spaced 16 inches on center each way.
- B. Grounds designed to receive clips for snap-on trim shall be continuous and be secured 300 mm (12 inches) on center. Space clips 300 mm (12 inches) on center.
- C. Miter trim at corners, conceal fasteners. Modify trim as required to conform to surrounding construction details. - - - E N
D - - -

THIS PAGE INTENTIONALLY LEFT BLANK

**SECTION 10 11 23
TACKBOARDS**

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This section specifies tackboards (bulletin boards) and related items.
- B. Boards may be either factory or field assembled.

1.2 RELATED WORK

- A. Section 10 11 13, MARKERBOARDS

1.3 QUALITY ASSURANCE

Boards shall be the products of one manufacturer.

1.4 SUBMITTALS

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA AND SAMPLES.
- B. Shop Drawings: Identifying all parts by name and material and showing design, construction, installation, anchorage and relation to adjacent construction.
- C. Manufacturer's Literature and Data: 1. Bulletin board.
- D. Samples:
 - 1. Tackboard, 300 by 300 mm (six by six inches), each color, mounted on backing.

1.5 APPLICABLE PUBLICATIONS

- A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.
- B. National Association of Architectural Metal Manufacturers (NAAMM):
 - AMP 500 Series Metal Finishes Manual
 - AMP 501 Finishes for Aluminum
- C. American National Standards (ANSI):
 - Z97.1-04 Safety Glazing Materials Used in Buildings - Safety Performance Specifications and Methods of Test
- D. American Society for Testing and Materials (ASTM):
 - B221/B221M-06 Aluminum and Aluminum Alloy Extruded Bars, Rods, Wire, Shapes and Tubes
 - C1036-06 Flat Glass
 - C1048-04 Heat-Treated Flat Glass-Kind HS, Kind FT Coated and Uncoated Glass
 - F104-03 Nonmetallic Gasket Materials

E. Composite Panel Association (CPA):

A208.1-06 Particleboard

A135.4-04 Basic Hardboard

PART 2 - PRODUCTS

2.1 BULLETIN BOARD

Bulletin board shall consist of a tackboard, snap on aluminum frame, grounds and other items specified and shown.

2.2 FABRICATION

A. Materials:

1. Aluminum, extruded: ASTM B221.
2. Cork: ASTM F104, Type II, mildew resistant, Class 2.
3. Backing: Hardboard, AHBA A135.4 or particleboard, CPA A208.1.

B. Components:

1. Tackboard: Cork face, 6 mm (1/4-inch) thick factory laminated to a hardboard or particleboard backing.
2. Frames (Trim): Extruded aluminum, 1.5 mm (0.060-inch) thick, snap-on type, approximate face width 44 mm (1-3/4 inch), depth and configuration as required to return to wall and engage clips.
3. Display Rail: Snap-on type, same materials as frames, approximate face width one inch with 6 mm (1/4-inch) thick cork insert.
4. Mullions: Snap-on type, same material and face width as frames, designed to finish flush with frame.
5. Grounds: Continuous zinc-coated (galvanized) steel or extruded aluminum members designed to support the tackboard and clips for snap-on frames.
6. Clips: Manufacturer's standard as required to support frame, mullions, and display rail,

C. Bulletin boards 3660 mm (12 feet) or less in length shall be in one piece.

D. Finish exposed aluminum surfaces as follows:

1. AA 45 chemically etched medium matte, with clear anodic coating Class II Architectural, 0.4 mils thick (AA-M12C22A32).

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

- A. Install units in accordance with the manufacturer's installation instructions, use concealed fasteners.
- B. Inspect surfaces and related construction to receive units. Partitions shall have reinforcing to receive fasteners. Verify type and placement of reinforcement.

C. Do not proceed with the installation until reinforcement is in place and surfaces are flat.

D. Assemble units as specified by the manufacturer.

3.2 INSTALLATION OF BULLETIN BOARD:

A. Mount bulletin boards with adhesive and blocking pads spaced 16 inches on center each way.

B. Grounds designed to receive clips for snap-on trim shall be continuous and be secured 300 mm (12 inches) on center. Space clips 300 mm (12 inches) on center.

C. Miter trim at corners, conceal fasteners. Modify trim as required to conform to surrounding construction details. - - - E N

D - - -

THIS PAGE INTENTIONALLY LEFT BLANK

SECTION 10 14 00
SIGNAGE

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This section specifies exterior building identification signs.
- B. Installation of Government furnished dedication plaques and VA seals.

1.3 MANUFACTURER'S QUALIFICATIONS

Sign manufacturer shall provide evidence that they regularly and presently manufacturer's signs similar to those specified in this section as one of their principal products.

1.4 SUBMITTALS

- A. Submit in accordance with Section 01 33 00, SHOP DRAWINGS, PRODUCT DATA AND SAMPLES.
- B. Manufacturer's Literature:
 - 1. Showing the methods and procedures proposed for the concealed anchorage of the signage system to each surface type.
 - 2. Manufacturer's printed specifications, anchorage details, installation and maintenance instructions.
- C. Samples: Sign location plan, showing location, type and total number of signs required, color samples, 150 mm x 150 mm (6 inches x 6 inches. Show anticipated range of color and texture.
- D. Shop Drawings: Scaled for manufacture and fabrication of sign types. Identify materials, show joints, welds, anchorage, accessory items, mounting and finishes, provide text layout and copy.

1.5 DELIVERY AND STORAGE

- A. Deliver materials to job in manufacturer's original sealed containers with brand name marked thereon. Protect materials from damage.
- B. Package to prevent damage or deterioration during shipment, handling, storage and installation. Maintain protective covering in place and in good repair until removal is necessary.
- C. Deliver signs only when the site and mounting services are ready for installation work to proceed.
- D. Store products in dry condition inside enclosed

facilities. 1.6 APPLICABLE PUBLICATIONS

- A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.
- B. American Society for Testing and Materials (ASTM):
 - B209-07Aluminum and Aluminum-Alloy Sheet and Plate

B221-06Aluminum and Aluminum-Alloy Extruded Bars, Rods,
Wire, Shapes, and tubes.

C. Department of Veterans Affairs, Exterior Sign Guide, February 2005.

PART 2 - PRODUCTS

2.1 GENERAL

- A. Signs of type, size and design shown on the drawings and as specified.
- B. Signs complete with lettering, framing and related components for a complete installation.
- C. Provide graphics items as completed units produced by a single manufacturer, including necessary mounting accessories, fittings and fastenings.
- D. Do not scale drawings for dimensions. Contractor to verify and be responsible for all dimensions and conditions shown by these drawings. Resident Engineer to be notified of any discrepancy in drawing, in field directions or conditions, and/or of any changes required for all such construction details.
- E. The Sign Contractor, by commencing work of this section, assumes overall responsibility, as part of his warranty of work, to assure that assemblies, components and parts shown or required within the work of the section, comply with the Contract Documents. The Contractor shall further warrant: That all components, specified or required to satisfactorily complete the installation are compatible with each other and with conditions of installations.

2.2 PRODUCTS

- A. Aluminum:
 - 1. Sheet and Plate: ASTM B209.
 - 2. Extrusions and Tubing: ASTM B221.
- D. Vinyl: 0.1 mm thick machine cut, having a pressure sensitive adhesive and integral colors.
- F. Concrete Post Footings: See Section 03 30 53, MISCELLANEOUS CAST-IN-PLACE CONCRETE, Cast-in-place Concrete.
- G. Steel: See Section 05 12 00, STRUCTURAL STEEL FRAMING.

2.3 SIGN STANDARDS

- A. Topography:
 - 1. Type Style: Helvetica Medium and Helvetica Medium Condensed. Initial caps or all caps as indicated in Sign Message Schedule.
 - 2. Arrow: See graphic standards in VA Sign Guide.
 - 3. Letter spacing: See graphic standards in VA Sign Guide.

4. All text, arrows, and symbols to be provided in size, colors, typefaces and letter spacing shown. Text shall be a true, clean, accurate reproduction of typeface(s) shown. Text shown in drawings are for layout purposes only; final text for signs is listed in Sign Message Schedule.

B. Project Colors and Finishes: As indicated in sign types below.

2.4 SIGN TYPES

A. General:

1. The exterior sign system shall be comprised of sign types families that are identified by a letter and number which identify a particular group of signs. An additional number identifies a specific type of sign within that family.
2. EN designation indicates exterior non-illuminated sign.

B. Sign Type Family EN-03

1. Provide sign type EN-03.05, non-illuminated exterior sign.
2. All text and graphics to be first surface reflective vinyl letters and symbols.
3. Size:
 - a. Sign Face: 3'-0" (914 mm) H. x 3'-0" (914) mm) W.
 - b. Overall Sign Height: 5'-6" (1676 mm)
4. Message Configuration:
 - a. Message Layout: Message Layout B per signage template attached at end of section.
 - b. Text:
 - Line 1: Buildings
 - Line 2: 121 & 122
 - Line 3: Community
 - Line 4: Living Center
 - Line 5: (CLC)
5. Colors:
 - a. Text: White T2
 - b. Background: Dark Bronze Anodized 313, B1.
 - c. Posts: Dark Bronze Anodized 313, P1.
6. Quantity: 1

C. Sign Type Family EN-006

1. Provide sign type EN-06.06, non-illuminated exterior sign.
2. All text and graphics to be first surface reflective vinyl letters and symbols.
3. Size:

- a. Sign Face: 2'-0" (610 mm) H. x 2'-0" (610) mm) W.
- b. Overall Sign Height: Mount sign on building face with top of sign 6'-0". Verify sign visibility before final installation, and adjust height and location as necessary.

4. Message Configuration:

- a. Message Layout: Message Layout A per signage template attached at end of section.
- b. Text: (Sign 1)
 - Line 1: Buildings
 - Line 2: 121
- c. Text: (Sign 2)
 - Line 1: Buildings
 - Line 2: 122

5. Colors:

- a. Text: White T2
- b. Background: Dark Bronze Anodized 313, B1.

6. Quantity: 1 each sign, (2 total of this sign type).

2.5 FABRICATION

- A. Design components to allow for expansion and contraction for a minimum material temperature range of 56 °C (100 °F), without causing buckling, excessive opening of joints or over stressing of adhesives, welds and fasteners.
- B. Form work to required shapes and sizes, with true curve lines and angles. Provide necessary rebates, lugs and brackets for assembly of units. Use concealed fasteners whenever and wherever possible.
- C. Shop fabricate so far as practicable. Joints fastened flush to conceal reinforcement, or welded where thickness or section permits.
- D. Contact surfaces of connected members be true. Assembled so joints will be tight and practically unnoticeable, without use of filling compound.
- E. Signs shall have fine, even texture and be flat and sound. Lines and miters sharp, arises unbroken, profiles accurate and ornament true to pattern. Plane surfaces be smooth flat and without oil-canning, free of rack and twist. Maximum variation from plane of surface plus or minus 0.3 mm (0.015 inches). Restore texture to filed or cut areas.
- F. Level or straighten wrought work. Members shall have sharp lines and angles and smooth surfaces.
- G. Extruded members to be free from extrusion marks. Square turns and corners sharp, curves true.

- H. Drill holes for bolts and screws. Conceal fastenings where possible. Exposed ends and edges mill smooth, with corners slightly rounded. Form joints exposed to weather to exclude water.
- I. Finish hollow signs with matching material on all faces, tops, bottoms and ends. Edge joints tightly mitered to give appearance of solid material.
- J. All painted surfaces properly primed. Finish coating of paint to have complete coverage with no light or thin applications allowing substrate or primer to show. Finished surface smooth, free of scratches, gouges, drips, bubbles, thickness variations, foreign matter and other imperfections.
- K. Pre-assemble items in shop to greatest extent possible to minimize field splicing and assembly. Disassemble units only as necessary for shipping and handling limitations. Clearly mark units for re-assembly and coordinated installation.
- L. No signs are to be manufactured until final sign message schedule and location review has been completed by the Resident Engineer & forwarded to contractor.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Protect products against damage during field handling and installation. Protect adjacent existing and newly placed construction, landscaping and finishes as necessary to prevent damage during installation. Paint and touch up any exposed fasteners and connecting hardware to match color and finish of surrounding surface.
- B. Mount signs in proper alignment, level and plumb according to the sign location plan and the dimensions given on elevation and sign location drawings. Where otherwise not dimensioned, signs shall be installed where best suited to provide a consistent appearance throughout the project. When exact position, angle, height or location is in doubt, contact Resident Engineer for clarification.
- C. Post and Panel signs shall be installed utilizing footings with 1'-6" (457 mm) cross section, and 2'-6" (762 mm) footing depth. Provide 3"-4" (75 mm-100 mm) drain rock below concrete footing and apply protective coating to aluminum post portion within concrete.
- D. Sign footings in landscape areas shall be boxed so as to extend 3 1/2" (90 mm) above grade with 2" (50 mm) bevel.

- E. Contractor shall be responsible for all signs that are damaged, lost or stolen while materials are on the job site and up until the completion and final acceptance of the job.
- F. Remove or correct signs or installation work Resident Engineer determines as unsafe or as an unsafe condition.
- G. At completion of sign installation, clean exposed sign surfaces. Clean and repair any adjoining surfaces and landscaping that became soiled or damaged as a result of installation of signs.
- H. Locate signs as shown on Drawings.
- I. Contractor will be responsible for verifying that behind each sign location there are no utility lines that will be affected by installation of signs. Any damage during installation of signs to utilities will be the sole responsibility of the Contractor to correct and repair.
- J. Furnish inserts and anchoring devices for installation of signs. Provide setting drawings, templates, instructions and directions for installation of anchorage devices which may involve other trades.

EN-03.05**Non-Illuminated Exterior Sign**

Primary Building Identification

Size

Sign Face:
914 mm H x 914 mm W
(3' 0" H x 3' 0" W)

Overall Sign Height
1676 mm (5' 6")

Description

Large, non-illuminated auto oriented building number/ identification post and panel sign for identification of a building when a large sign is needed because the building is set back away from the roadway or the architectural scale (size) of the building warrants a large sign.



Message Configuration (Refer to message layout drawing for dimensions)

Message size and layout should adjust to the volume of information being presented. Layouts illustrated show small, medium and large size text. Smaller text than shown should not be used as the messages will be unreadable to drivers. Larger text than shown will result in words that may not fit on the sign.

**Graphic Process**

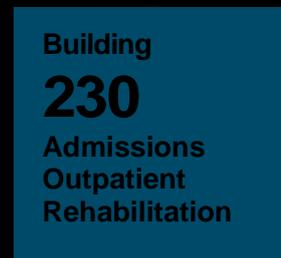
Surface applied reflective vinyl.

Colors

Text: White T2
Background Refer to Color Chart
Post Refer to Color Chart

Recommendations

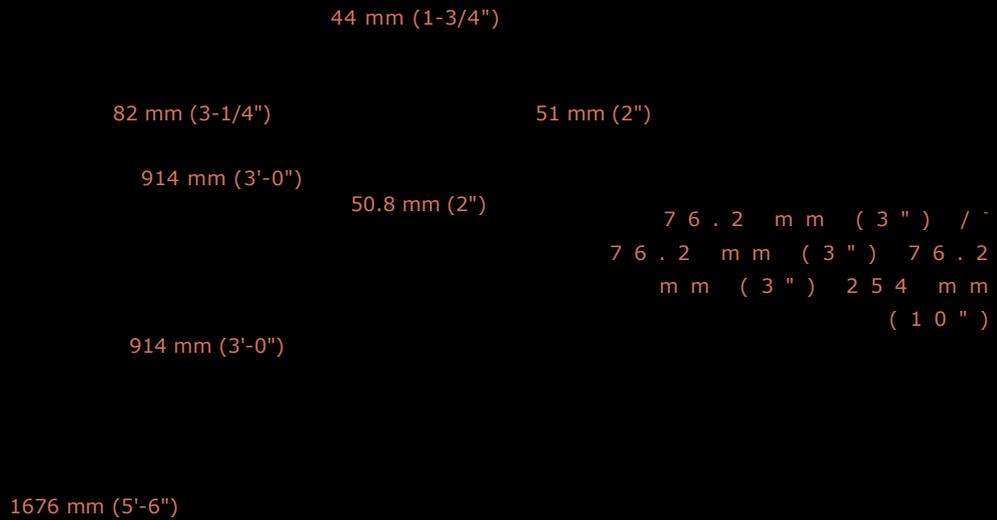
Position sign so drivers have a clear, unobstructed view of the sign.

Message Layout A**Message Layout B**

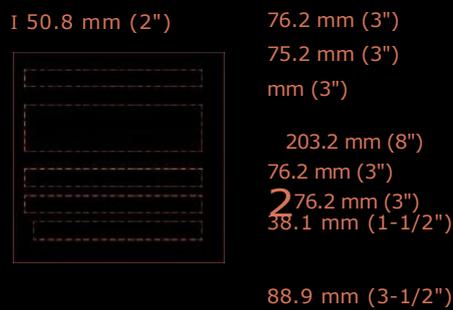
EN-03.05

Non-Illuminated Exterior Sign

Primary Building Identification



Message Layout A



Message Layout B

EN-06.06**Non-Illuminated Exterior Sign**

Wall Mounted Building Identification

Size

Sign Face:
610mm Hx610 mmW
(2' H x 2' 0" W)

Description

Standard size, non-illuminated wall mounted sign. Building identification with and without names of the occupant or service.

Message Configuration

(Refer to message layout drawing for dimensions)

Message layouts show application of the sign with building identification number and number with secondary information.

Graphic Process

Surface applied reflective vinyl.

Colors

Text: White T2
Background: Refer to Color Chart

Recommendations Use on any building. Position the sign adjacent to or above the main entrance, if possible. If the sign is not readable in this position, then locate on the corner of the building.



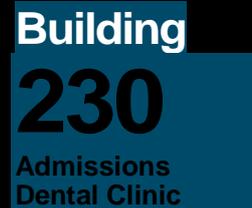
Building
230

Message Layout A



Building
230

Message Layout B



Building
230
Admissions
Dental Clinic

Message Layout C



Freight
Receiving

EN-06.06

Non-Illuminated Exterior Sign

Wall Mounted Building Identification Sign

25 mm (1")

610 mm (2'-0")
50,8 mm (2")



510 mm

76.2 mm (3") — 75.2 mm (3")
50.8 mm (2") — 152.4 mm (6")
(2") — 152.4 mm (6")

Message Layout A

60.5 mm (2")



76.2 mm (3")
76.2 mm (3")
50.8 mm (2")
152.4 mm (6")
50.8 mm (2")
50.6 mm (2")
25.4 mm (1")

Message Layout B

• 50.8 mm (2")

76.2 mm (3")
—120.6 mm (4-3/4")
| 38.1 mm (1-1/2")
76.2 mm (3")
38.1 mm (1-1/2")

M e s s a g e

----- **Layout C**

-----**END**-----

SECTION 10 21 23
CUBICLE CURTAIN TRACKS

PART 1 - GENERAL

1.1 DESCRIPTION

This section specifies cubicle curtain track (C.C.T.), and cubicle shower curtains.

1.2 RELATED WORK

Steel shapes for suspending track assembly: Section 05 50 00, METAL FABRICATIONS and Section 09 51 00, ACOUSTICAL CEILINGS.

1.3 SUBMITTALS

A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

B. Samples:

1. One 300 mm (12 inch) long piece of cubicle curtain track with carrier access and end stop.

2. For each type of curtain material indicated.

a. Curtain Fabric: 304.8 mm (12 inch) square swatch. Mark top and face of material.

b. Mesh Top: Not less than 101.6 mm (4 inches).

C. Manufacturer's Literature and Data:

1. Cubicle curtain track and each type of curtain

fabric. 1.4 DELIVERY, STORAGE AND HANDLING

A. Deliver material in original package marked to identify the contents, brand name, and the name of the manufacturer or supplier.

B. Store in dry and protected location. Store so as to not bend or warp the tracks.

C. Do not open packages until contents are needed for installation, unless verification inspection is required.

1.5 APPLICABLE PUBLICATIONS

A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.

B. American Society for Testing and Materials (ASTM):

B221-06 Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Shapes, and Tubes.

B456-03 Electrodeposited Coatings for Copper Plus Nickel Plus Chromium and Nickel Plus Chromium

C. The National Association of Architectural Metal Manufacturers (NAAMM):

AMP 500 Series Metal Finishes Manual

PART 2 - PRODUCTS

2.1 CUBICLE CURTAIN TRACKS

- A. Surface mounted:
 - 1. Channel Tracks (Surface Mounted Type): Extruded aluminum, ASTM B221, alloy 6063, temper T5 or T6, channel shaped, with smooth inside raceway for curtain carriers.
- B. Curtain Carriers: Nylon or delrin carriers, with either nylon or delrin wheels on metal, delrin, or nylon axles. Equip each carrier with either stainless steel, chromium plated brass or steel hooks with swivel, or nickel chromium plated brass or stainless steel bead chain and hook assembly, or delrin carriers may have moulded on delrin hooks. Hook for bead chain may be the same material and finish as the bead chain or may be chromium plated steel. Provide 2.2 carriers for every 300 mm (onefoot) of each section of each track length, plus one additional carrier.
- C. End Stop Connectors, Ceiling Flanges and Other Accessories: Fabricate from the same material with the same finish as the tracks or from nylon.
- D. Hangers and Fittings: Fabricate from the same material with the same finish as the tracks. Hangers may be round or square for channel tracks and round for tubular tracks. Design fittings to be compatible with design of tracks and to safely transmit the track load to the hangers.
- E. At end of each section of track, make provision for insertion and removal of carriers. Design to prevent accidental removal of carrier. Any operating mechanism shall be removable with common tools.

2.2 CUBICLE CURTAINS

- A. Fabrics are launderable to a temperature of not more than 160 deg F (71 deg C).
- B. Fabrics are inherently flame resistant and are identical to those that have passed NFPA 701 when tested by a testing and inspecting agency acceptable to authorities having jurisdiction.

2.3 VINYL

- A. Construction: 1 3/8" triple thick top hem consisting of one ply of the curtain material, a 1 1/8" reinforcement header strip of closely woven mesh, covered by a 6 gauge clear strip of vinyl; SAFE-T-TOP™ to be sewn with double needle construction, 1 1/8" between stitching rows.
- B. Hem: Top hem to also have two-piece rustproof anodized aluminum grommets on 6" centers. No bottom hem, allowing for easy run-off of soap and water.

C. Vinyl to be formulated with an anti-microbial to insure maximum mildew resistance for the life of the shower curtain.

D. Anti-static vinyl.

2.4 FASTENERS

A. Exposed Fasteners, Screws and Bolts: Stainless steel or chromium/nickel plated brass.

B. Concealed Fasteners, Screws and Bolts: Hot-dip galvanized (except in high moisture areas use stainless steel).

C. Metal Clips: Anchor curtain tracks to exposed grid of lay-in acoustical tile ceilings, with concealed metal (butterfly) type or two piece snap locking type ceiling clip of high strength spring steel. When it is not possible to install the metal ceiling clip, the cubicle curtain track may be screwed to the ceiling grid.

2.5 FINISHES

A. Chrome/Nickel Plating: Satin or polished finish as specified, ASTM B546, minimum thickness of chromium plate as follows:

1. 0.2 mil on copper alloys.
2. 0.4 mil on steel.

2.6 FABRICATION

A. Weld and grind smooth joints of fabricated components.

B. Form tracks and bends of lengths that will produce the minimum number of joints. Make track sections up to 4800 mm (16 feet) without joints. Form corner bend on a 300 mm (12 inch) radius.

C. Provide steel anchor plates, supports, and anchors for securing components to building construction.

D. Form flat surface without distortion.

E. Shop assemble components and package complete with

anchors and fittings. PART 3 - EXECUTION 3.1

INSTALLATION

A. Install tracks after finish painting and ceiling finishing operations are complete.

B. Install track level and hangers plumb and securely anchor to the ceiling to form a rigid installation.

C. Anchor surface mounted curtain tracks directly to exposed grid of lay-in acoustical tile ceilings with suitable fasteners, spaced approximately 600 mm (24 inches) on center.

D. Anchor surface mounted curtain tracks to concrete, plaster and gypsum board ceilings with a minimum of 3 mm (1/8-inch) diameter fastenings or concealed clips spaced not more than 900 mm (three feet) on center.

- E. Securely fasten end stop caps to prevent their being forced out by the striking weight of carriers.
- F. Remove damaged or defective components and replace with new components or repair to the original condition.
- G. Provide curtain carriers adequate for 152 mm (6 inch) spacing along full length of curtain plus an additional carrier.
- H. Hang curtains on each curtain track. Secure with curtain tieback.

3.2 ACCEPTANCE

- A. Track shall be installed neat, rigid, plumb, level and true, and securely anchored to the overhead construction.
- B. Carrier units shall operate smoothly and easily over the full range of travel.

- - - E N D - - -

SECTION 10 25 13
PATIENT BED SERVICE WALLS

PART 1 - GENERAL

1.1 DESCRIPTION

This section specifies the furnishing, installation and connection of the patient wall systems both horizontal and vertical. Patient wall systems are also referred to as prefabricated bedside patient units or PBPUs.

1.2 RELATED WORK

- A. Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS: General electrical requirements that are common to more than one section of Division 26.
- B. Section 26 05 33, RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS: Raceways and outlet boxes for wiring.
- C. Section 26 05 21, LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES (600 VOLTS AND BELOW): Cables and wiring.
- D. Section 26 27 26, WIRING DEVICES: Wiring devices to be installed in the patient wall units.
- E. Section 26 24 16, PANELBOARDS: Panelboard requirements for patient wall units with a panelboard.
- F. Section 26 05 26, GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS: Requirements for personnel safety and to provide a low impedance path to ground for possible ground currents.
- G. Section 26 51 00, INTERIOR LIGHTING: Lighting fixture requirements when installed in or connected to the patient wall units.
- H. Section 27 52 23, NURSE CALL/CODE BLUE SYSTEMS: Nurse Call and Code One requirements for installation in the patient wall units.

1.3 SUBMITTALS

- A. In accordance with Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS, submit the following:
- B. Shop Drawings:
 - 1. Sufficient information, clearly presented, shall be included to determine compliance with drawings and specifications.
 - 2. Include electrical ratings, dimensions, mounting details, front view, side view, equipment and device arrangement, wiring diagrams, material, and connection diagrams.

3. Determine final layout of each style of patient wall system at this stage. Provide configuration drawings showing all possible device (nurse call, medical gases, electrical receptacles and switches, etc.) locations to the COTR. The COTR will provide by return of submittal the desired configuration of each style of patient wall system. Limit the number and type of devices allowed for each style of unit to the number and type of devices specified for that style below.
- C. Manuals: Two weeks prior to the final inspection, deliver four copies of the following to the Resident Engineer.
1. Complete maintenance and operating manuals including wiring diagrams, technical data sheets, and information for ordering replacement parts:
 - a. Include complete "As installed" diagrams which indicate all items of equipment, their interconnecting wiring and interconnecting piping.
 - b. Include complete diagrams of the internal wiring for each of the items of equipment, including "As installed" revisions of the diagrams.
 - c. Identify terminals on the wiring diagrams to facilitate installation, maintenance and operation.
- D. Certifications: Two weeks prior to the final inspection, deliver four copies of the following certifications to the Resident Engineer:
1. Certification by the manufacturer that the equipment conforms to the requirements of the drawings and specifications.
 2. Certification by the Contractor that the equipment has been properly installed, adjusted, and tested in accordance with the manufacturer's recommendations.

1.4 APPLICABLE PUBLICATIONS:

- A. Publications listed below (including amendments, addenda, revisions, supplements and errata) form a part of this specification to the extent referenced. Publications are referenced in text by the basic designation only.
- B. National Fire Protection Association (NFPA):
 - 70-07 National Electrical Code (NEC)
 - 99-05 Health Care Facilities
- C. Underwriters Laboratories, Inc. (UL):
 - UL listed in product category SECTIONS AND UNITS (QQXX). This standard used to investigate listed products in this category is NFPA 70 (NEC).

PART 2 - PRODUCTS

2.1 PATIENT WALL SYSTEMS

- A. Shall be UL listed.
- B. Shall consist of a structural framework, removable panels and removable equipment console units, factory assembled to house all permanent bedside services including but not necessarily limited to fixtures, grounding jacks, power outlets, telephone outlet, nurses call patient station, medical gas outlet(s) and other fittings or devices.
- C. Shall conform to the following:
 - 1. Applicable requirements in NFPA 70 (NEC) and NFPA 99.
 - 2. Assembly and all components shall be UL listed or labeled.
- D. Coordinate the mounting space provisions for the nurse call equipment with Section 27 52 23, NURSE CALL/CODE BLUE SYSTEMS.
- E. Oxygen: Furnish, install and test the equipment in accordance with the drawings and Section 22 63 00, GAS SYSTEMS FOR LABORATORY AND HEALTHCARE FACILITIES.
 - 1. Fixed medical gas outlets are permanently installed in one location and may not be moved without special tools and shutting off the gas involved.
- F. Electrical receptacles and switches shall comply with the requirements in Section 26 27 26, WIRING DEVICES; grounding in Section 26 05 26, GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS; and internal wiring in Section 26 05 21, LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES (600 VOLTS AND BELOW).
- G. Styles:
 - 1. Style A1: A single bed patient wall unit consisting of a horizontal unit. Horizontal units shall consist of a minimum of three rails (two rails can be used if the bed light is independently mounted). Patient bed light power must be wired through the patient wall unit. Provide a middle rail for power, nurses call and medical gases as well as a bottom rail with bed bumper and for bed motor power. The horizontal unit shall have a vertical chase connecting the rails to the above ceiling junction boxes and gas connection points.
 - a. Provide oxygen gas outlet(s): 2-each fixed.
 - b. Provide emergency power outlets: 2-each NEMA 20R single receptacles, self illuminated red with stainless steel or anodized aluminum cover plate, engraved "EMERGENCY POWER" with minimum 6 mm (1/4 inch) red filled letters.

- c. Provide normal power outlets: 3-each NEMA 20R single white receptacles. One of which is for the bed motor. Provide stainless steel or anodized aluminum cover plates.
 - d. Provide Nurses Call audio-visual single bed station.
 - e. Provide Tele-cart jack.
 - f. Provide an auxiliary light (6 to 7 watts) with hood and switch. Both shall be mounted on a stainless steel or an anodized aluminum face plate installed in a single gang box.
 - g. Provide a switch for the overhead/exam light.
 - h. Provide a patient wall mounted bed light fixture. Refer to Section 26 51 00, INTERIOR LIGHTING. The bed light shall be powered through the patient wall unit.
- H. All styles of the units shall have the following features:
- 1. Basic structural framework shall be constructed of heavy gage extruded aluminum or minimum 1.9 mm (14 gage) cold-rolled steel, designed to be a self-supporting unit for above-the-floor, for close wall mounting or a freestanding installation. For freestanding units, provide the framework with a base plate and overhead structural supports.
 - 2. Drill and tap the side frame members to permit the installation of front panel devices at modular intervals at any elevation between the top and bottom.
 - 3. Provide removable front panels:
 - a. Construct panel of the following materials:
 - 1) Fire retarding core material surfaced with a high pressure plastic laminated facing sheet.
 - 2) Vinyl material heat and pressure applied over a minimum of 1.6 mm (0.060 inch) sheet aluminum back braced for rigidity and sound control.
 - 3) Vinyl material heat and pressure applied over sheet steel minimum 1.6 mm (0.060 inch).
 - 4) Vinyl material heat and pressure applied over sheet aluminum minimum 2.0 mm (0.080 inch).
 - b. Color and texture shall be selected from manufacturer's full line of finishes.
 - c. Bond the panel edges with an aluminum extrusion or cold-rolled steel trim designed for mounting directly to the structural framework, thus allowing the panels to be easily removed for access to internal components and for servicing of utility connections or future modifications. Secure panels with hidden

screws or other means to offer an overall finished appearance.

All exposed metal surfaces or trims greater than 4 mm (1/8 inch) wide shall be of anodized aluminum or stainless steel finished to resist abrasion and affects from hospital cleaning compounds.

4. Units need not have back panels, provided they are edge gasketed to the wall or totally and inconspicuously edge sealed to the wall with a resilient caulking material. Attach side and back panels [sheet steel, a minimum of 1.6 mm (0.060 inch)] or equivalent strength aluminum side and back panels, with flush screws to permit close wall mounting. Finish side panels to match or compliment the front panels.
5. Mount patient service components in an equipment console made up of a backbox and finish fascia.
 - a. Use galvanized steel backbox with outlet gang openings on minimum 60 mm (2.4 inches) uniform centers to provide mounting supports of front panel devices. Provide removable metal barriers to separate voltage sources and to facilitate wiring between segregated devices within the same horizontal module.
 - b. Match finish, either anodized aluminum or stainless steel of all fascia and device face plates.
 - c. Fascia and/or face plates may be omitted for power and grounding receptacles in the consoles if the receptacles are mounted flush in the PBPU cover panel and facilities (support members, tapped holes, spacing, etc.) are provided behind the panel for future addition or relocation of receptacles.
 - d. Provide smooth external surfaces having a finished appearance. Maintain adequate spacing of device plates and similar items to eliminate crevices and facilitate cleaning.
6. Provide patient services as indicated in paragraphs Styles above, the schematic wiring diagram shown on drawings, and as follows:
 - a. Electrical components: Factory assembled and prewired to a sectionalized junction box at the top of the unit in accordance with circuiting and switching arrangements shown on the drawings. Factory assembled prewiring may be stranded in sizes AWG #10 and #12. Provide an equipotential ground bus with lugs suitable for connecting AWG #14 to AWG #6 conductors with a minimum of 48 screw-type terminals, unless otherwise shown.
 - b. Receptacles: Single Hospital Grade NEMA 5-20R, unless otherwise specified.

- c. Provide medical gas components compatible with those installed elsewhere in the project that are factory assembled, manifolded and pre-piped, using medical grade copper pipe, to single point connections of each service at the top of the units.
- d. Provide nurse call services consisting of provisions for adequate space and matching face plates for the equipment and empty conduit to the sectionalized junction box at the top of the unit.
- e. Provide internal power and signal wiring in separate EMT, flexible metal conduits or approved raceway. Separate normal power circuits from emergency power circuits. Also, provide adequate supports for conduits and piping within the structural frame.
- f. Telephone outlets/jacks: Plug-in type as approved by the VAMC.
- g. Except for anodized aluminum and galvanized or stainless steel surfaces, clean and paint all other metal surfaces at the factory with primer and not less than two coats of baked enamel.

PART 3 - EXECUTION

3.1 INSTALLATION:

- A. Installation shall be in accordance with NFPA 70 (NEC), NFPA 99, and as shown on the drawings.
- B. Oxygen System Equipment:
 - 1. Install and test the equipment and piping system in accordance with the drawings and Section 22 63 00, GAS SYSTEMS FOR LABORATORY AND HEALTHCARE FACILITIES.
 - 2. Install and make connections as required for a complete and operational patient wall system for each unit.

- - - E N D - - -

SECTION 10 26 00
WALL AND DOOR PROTECTION

PART 1 - GENERAL

1.1 DESCRIPTION

A. This section specifies handrail and corner guards.

1.2 RELATED WORK

A. Armor plates and kick plates not specified in this section: Section 08 71 00, DOOR HARDWARE.

1.3 SUBMITTALS

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Shop Drawings: Show locations, design and installation details.
- C. Manufacturer's Literature and Data:
 - 1. Handrail.
 - 2. Corner Guards.

1.4 DELIVERY AND STORAGE

- A. Deliver materials to the site in original sealed packages or containers marked with the name and brand, or trademark of the manufacturer.
- B. Protect from damage from handling and construction operations before, during and after installation.
- C. Store in a dry environment of approximately 21° C (70 degrees F) for at least 48 hours prior to installation.

1.5 APPLICABLE PUBLICATIONS

- A. Publications listed below form a part of this specification to extent referenced. Publications are referenced in text by basic designation only.
- B. American Society for Testing and Materials (ASTM):
 - B221-08 Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Shapes, and Tubes
 - D256-06 Impact Resistance of Plastics
 - D635-06 Rate of Burning and/or Extent and Time of Burning of Self-Supporting Plastics in a Horizontal Position
 - E84-09 Surface Burning Characteristics of Building Materials
- C. The National Association of Architectural Metal Manufacturers (NAAMM):
 - AMP 500-06 Metal Finishes Manual
- D. Underwriters Laboratories Inc. (UL):
 - Annual Issue Building Materials Directory

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Aluminum Extruded: ASTM B221, Alloy 6063, Temper T5 or T6. Aluminum alloy used for colored anodizing coating shall be as required to produce specified color.
- B. Resilient Material:
 - 1. Extruded and injection molded acrylic vinyl or extruded polyvinyl chloride meeting following requirements:
 - a. Minimum impact resistance of 1197 ps (25 ft lbs per sq.ft) when tested in accordance with ASTM D256 (Izod impact, ft.lbs. per inch notch).
 - b. Class 1 fire rating when tested in accordance with ASTM E84, having a maximum flame spread of 25 and a smoke developed rating of 450 or less.
 - c. Rated self extinguishing when tested in accordance with ASTM D635.
 - d. Material shall be labeled and tested by Underwriters Laboratories or other approved independent testing laboratory.
 - e. Integral color with all colored components matched in accordance with SAE J 1545 to within plus or minus 1.0 on the CIE-LCH scales.
 - f. Same finish on exposed surfaces.

2.2 CORNER GUARDS

- A. Resilient, Shock-Absorbing Corner Guards: Surface mounted type 6 mm 1/4-inch corner).
 - 1. Snap-on corner guard formed from resilient material, minimum 2 mm (0.078-inch) thick, free floating on a continuous 1.52 mm (0.060-inch) thick extruded aluminum retainer. Provide appropriate mounting hardware, cushions and base plates as required.
 - 2. Provide factory fabricated end closure caps at top and bottom of surface mounted corner guards.
- B. Basis-of-Design:
 - 1. Koroseal, Korogard G200-Series
 - 2. or Approved equal.

2.3 HANDRAILS

- A. Resilient Handrails:
 - 1. Handrail: Snap-on covers of resilient material, minimum 1.52 mm (0.060-inch) thick, shall be free-floated on a continuous, extruded aluminum retainer, minimum 2.54 mm (0.100-inch) thick, anchored to wall at maximum 760 mm (30 inches) on center.

2. Provide handrails with prefabricated and closure caps, inside and outside corners, concealed splices, cushions, mounting hardware and other accessories as required. End caps and corners shall be field adjustable to assure close alignment with handrails and wall guards (crash rails). Screw or bolt closure caps to aluminum retainer.

2.4 FASTENERS AND ANCHORS

- A. Provide fasteners and anchors as required for each specific type of installation.
- B. Where type, size, spacing or method of fastening is not shown or specified, submit shop drawings showing proposed installation details.

2.5 FINISH

- A. In accordance with NAAMM AMP 500 series.
- B. Aluminum:
 1. Concealed aluminum: Mill finish as fabricated, uniform in color and free from surface blemishes.
- C. Resilient Material: Embossed texture and color in accordance with SAE J 1545 and as specified in Drawings.

PART 3 - INSTALLATION

3.1 RESILIENT CORNER GUARDS

Install corner guards on walls in accordance with manufacturer's instructions.

3.2 RESILIENT HANDRAIL

Secure handrails to walls with brackets and fasteners in accordance with manufacturer's details and instructions.

- - - E N D - - -

THIS PAGE INTENTIONALLY LEFT BLANK

SECTION 10 28 00
TOILET, BATH, AND LAUNDRY ACCESSORIES

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This section specifies manufactured items usually used in dressing rooms, toilets, baths, locker rooms and at sinks in related spaces.
- B. Items Specified:
 - 1. Baby changing station.
 - 2. Grab Bars: (10800-1.DWG).
 - 3. Clothes hooks, robe or coat.
 - 4. Metal framed mirror: (10800-7.DWG).
 - 5. Medicine cabinet.
 - 6. Shower seat.
 - 7. Shelf with W/MDP and broom holder.

1.2 RELATED WORK

- A. Reference Sheet AA8.0 and BA8.0 for additional information.

1.3 SUBMITTALS

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Manufacturer's Literature and Data:
 - 1. All accessories specified.
 - 2. Show type of material, gages or metal thickness in inches, finishes, and when required, capacity of accessories.
 - 3. Mop racks.

1.4 QUALITY ASSURANCE

- A. Each product shall meet, as a minimum, the requirements specified, and shall be a standard commercial product of a manufacturer regularly presently manufacturing items of type specified.
- B. Each accessory shall be assembled to the greatest extent possible before delivery to the site.
- C. Include additional features, which are not specifically prohibited by this specification, but which are a part of the manufacturer's standard commercial product.

1.5 PACKAGING AND DELIVERY

- A. Pack accessories individually to protect finish.
- B. Deliver accessories to the project only when installation work in rooms is ready to receive them.
- C. Deliver inserts and rough-in frames to site at appropriate time for building-in.

- D. Deliver products to site in sealed packages of containers; labeled for identification with manufacturer's name, brand, and contents.

1.6 STORAGE

- A. Store products in weathertight and dry storage facility.
- B. Protect from damage from handling, weather and construction operations before, during and after installation in accordance with manufacturer's instructions.

1.7 APPLICABLE PUBLICATIONS

- A. Publications listed below form a part of this specification to the extent referenced. Publications are referenced in the text by the basic designation only.
- B. American Society for Testing and Materials (ASTM):
- | | | |
|-----------------|-------|--|
| A167-99(R2004) | ..... | Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet and Strip. |
| A176-99(R2004) | ..... | Stainless and Heat-Resisting Chromium Steel Plate, Sheet, and Strip |
| A269-07 | ..... | Seamless and Welded Austenitic Stainless Steel Tubing for General Service |
| A312/A312M-06 | ..... | Seamless and Welded Austenitic Stainless Steel Pipes |
| A653/A653M-07 | ..... | Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process |
| B221-06 | ..... | Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Shapes, and Tubes |
| B456-03 | ..... | Electrodeposited Coatings of Copper Plus Nickel Plus Chromium and Nickel Plus Chromium |
| C1036-06 | ..... | Flat Glass |
| C1048-04 | ..... | Heat-Treated Flat Glass-Kind HS, Kind FT Coated and Uncoated Glass |
| D635-06 | ..... | Rate of Burning and/or Extent and Time of Burning of Self Supporting Plastics in a Horizontal Position |
| F446-85 (R2004) | ..... | Consumer Safety Specification for Grab Bars and Accessories Installed in the Bathing Area. |
| A269-07 | ..... | Seamless and Welded Austenitic Stainless Steel Tubing for General Service |

- D3453-01Flexible Cellular Materials - Urethane for Furniture and Automotive Cushioning, Bedding, and Similar Applications
- D3690-02 Vinyl-Coated and Urethane-Coated Upholstery Fabrics
- C. The National Association of Architectural Metal Manufacturers (NAAMM):
- AMP 500 SeriesMetal Finishes Manual
- AMP 500-505-88 Metal Finishes Manual and Finishes for Stainless Steel
- D. American Welding Society (AWS):
- D10.4-86 (R2000)Welding Austenitic Chromium-Nickel Stainless Steel Piping and Tubing
- E. Federal Specifications (Fed. Specs.):
- A-A-3002Mirrors, Glass
- FF-S-107C (2) Screw, Tapping and Drive
- FF-S-107CScrew, Tapping and Drive.
- WW-P-541E(1) Plumbing Fixtures (Accessories, Land Use) Detail Specification

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Aluminum: ASTM B221, alloy 6063-T5 and alloy 6463-T5.
- B. Stainless Steel:
1. Plate or sheet: ASTM A167, Type 302, 304, or 304L, except ASTM A176 where Type 430 is specified, 0.0299-inch thick unless otherwise specified.
 2. Tube: ASTM A269, Alloy Type 302, 304, or 304L.
- C. Stainless Steel Tubing: ASTM A269, Grade 304 or 304L, seamless or welded.
- D. Stainless Steel Pipe: ASTM A312; Grade TP 304 or TP 304L.
- E. Steel Sheet: ASTM A653, zinc-coated (galvanized) coating designation G90.
- F. Glass:
1. ASTM C1036, Type 1, Class 1, Quality q2, for mirrors, and for mirror doors in medicine cabinets.
 2. ASTM C1036, Type 1 Class 1 Quality q3, for shelves in medicine cabinets.
- G. Foam Rubber: ASTM D3453, Grade BD, Type 2.
- H. Vinyl Covering: ASTM D3690, Vinyl coated fabric, Class A.
- I. Plywood: PS1, Grade CD, fire treated.

2.2 FASTENERS

- A. Exposed Fasteners: Stainless steel or chromium plated brass, finish to match adjacent surface.
- B. Concealed Fasteners: Steel, hot-dip galvanized (except in high moisture areas such as showers or bath tubs use stainless steel).
- C. Toggle Bolts: For use in hollow masonry or frame construction.
- D. Hex bolts: For through bolting on thin panels.
- E. Expansion Shields: Lead or plastic as recommended by accessory manufacturer for component and substrate for use in solid masonry or concrete.
- F. Screws:
 - 1. ASME B18.6.4.
 - 2. Fed Spec. FF-S-107, Stainless steel Type A.
- G. Adhesive: As recommended by manufacturer for products to be

joined. 2.3 FINISH

- A. In accordance with NAAMM AMP 500 series.
- B. Anodized Aluminum:
 - 1. AA-C22A41 - Chemically etched medium matte, with clear anodic coating, Class I Architectural, 0.7-mil thick.
 - 2. AA-C22A44 - Chemically etched medium matte with electrolytically deposited metallic compound, integrally colored coating Class I Architectural, 0.7-mil thick finish. Dyes will not be accepted.
- C. AA-M32 - Mechanical finish, medium satin.
 - 1. Chromium Plating: ASTM B456, satin or bright as specified, Service Condition No. SC2.
 - 2. Stainless Steel: NAAMM AMP 503, finish number 4.
 - 3. Ferrous Metal:
 - a. Shop Prime: Clean, pretreat and apply one coat of primer and bake.
 - b. Finish: Over primer apply two coats of alkyd or phenolic resin enamel, and bake.
 - 4. Nylon Coated Steel: Nylon coating powder formulated for a fluidized bonding process to steel to provide a hard smooth, medium gloss finish, not less than 0.3 mm (0.012-inch) thick, rated as self-extinguishing when tested in accordance with ASTM D635.

2.4 FABRICATION - GENERAL

- A. Welding, AWS D10.4.
- B. Grind dress, and finish welded joints to match finish of adjacent surface.
- C. Form exposed surfaces from one sheet of stock, free of joints.

- D. Provide steel anchors and components required for secure installation.
- E. Form flat surfaces without distortion. Keep exposed surfaces free from scratches and dents. Reinforce doors to prevent warp or twist.
- F. Isolate aluminum from dissimilar metals and from contact with building materials as required to prevent electrolysis and corrosion.
- G. Hot-dip galvanized steel, except stainless steel, anchors and fastening devices.
- H. Shop assemble accessories and package with all components, anchors, fittings, fasteners and keys.
- I. Key items alike.
- J. Provide templates and rough-in measurements as required.
- K. Round and deburr edges of sheets to remove sharp

edges. 2.5 BABY CHANGING STATION

- A. Recessed type.
- B. 18 6A stainless steel exterior/molded high-density grey polyethylene with Microban antimicrobial interior.
- C. Concealed hinge and pneumatic cylinder.
- D. ADA accessible.
- E. Nylon safety secure strap and bag hook.
- F. Liner Dispenser.

2.6 GRAB BARS

- A. Fed. Spec WW-P-541/8B, Type IV, bars, surface mounted, Class 2, grab bars and ASTM F446.
- B. Fabricate of either stainless steel or nylon coated steel, except use only one type throughout the project:
 - 1. Stainless steel: Grab bars, flanges, mounting plates, supports, screws, bolts, and exposed nuts and washers.
 - 2. Nylon Coated Steel: Grab bars and flanges complete with mounting plates and fasteners.
- C. Concealed mount, except at swing up grab bars
- D. Bars:
 - 1. Fabricate from 38 mm (1-1/2 inch) outside diameter tubing.
 - a. Stainless steel, minimum 1.2 mm (0.0478 inch) thick.
 - b. Nylon coated bars, minimum 1.5 mm (0.0598 inch) thick.
 - 2. Fabricate in one continuous piece with ends turned toward walls, except swing up and where grab bars are shown continuous around three sides of showers, bars may be fabricated in two sections, with concealed slip joint between.
 - 3. Continuous weld intermediate support to the grab bar.

4. Swing up bars manually operated. Designed to prevent bar from falling when in raised position.

E. Flange for Concealed Mounting:

1. Minimum of 2.65 mm (0.1046 inch) thick, approximately 75 mm (3 inch) diameter by 13 mm (1/2 inch) deep, with provisions for not less than three set screws for securing flange to back plate.
2. Insert grab bar through center of the flange and continuously weld perimeter of grab bar flush to back side of flange.

F. Flange for Exposed Mounting:

1. Minimum 5 mm (3/16 inch) thick, approximately 75 mm (3 inch) diameter.
2. Insert grab bar through flange and continuously weld perimeter of grab bar flush to backside of flange.

G. In lieu of providing flange for concealed mounting, and back plate as specified, grab rail may be secured by being welded to a back plate and be covered with flange.

H. Back Plates:

1. Minimum 2.65 mm (0.1046 inch) thick metal.
2. Fabricate in one piece, approximately 6 mm (1/4 inch) deep, with diameter sized to fit flange. Provide slotted holes to accommodate anchor bolts.

2.7 SHOWER CURTAIN AND TRACKS

- A. Aluminum Ceiling Mount Track - Heavy Duty, 6063-T5
- B. Two Way Hand Draw Track with double wheel integrated carrier. Include all accessories for mounting to ceiling.
- C. Form to radius on plan.
- D. Shower Curtain: Antibacterial, nylon reinforced vinyl, min 10 02 (284g) or 0.008 inch (0.2 mm) thick.
- E. Color: Selected from manufacturer's full range of colors.
- F. Supply hardware to work with

track. 2.8 CLOTHES HOOKS-ROBE OR COAT

- A. Fabricate hook units either of chromium plated brass with a satin finish, or stainless steel, using 6 mm (1/4 inch) minimum thick stock, with edges and corners rounded smooth to the thickness of the metal, or 3 mm (1/8 inch) minimum radius.
- B. Fabricate each unit as a double hook on a single shaft, integral with or permanently fastened to the wall flange, provided with concealed fastenings.

2.9 METAL FRAMED MIRRORS

- A. Fed. Spec. A-A-3002 metal frame; chromium finished steel, type 302 or 304.
- B. Mirror Glass:
 - 1. Minimum 6 mm (1/4 inch) thick.
 - 2. Set mirror in a protective vinyl glazing tape.
- C. Frames:
 - 1. Channel or angle shaped section with face of frame not less than 9 mm (3/8 inch) wide. Fabricate with square corners.
 - 2. Use either 0.9 mm (0.0359 inch) thick stainless steel, chrome finished steel, or extruded aluminum, with clear anodized finish 0.4 mils thick.
 - 3. Filler:
 - a. Where mirrors are mounted on walls having ceramic tile wainscots not flush with wall above, provide fillers at void between back of mirror and wall surface.
 - b. Fabricate fillers from same material and finish as the mirror frame, contoured to conceal the void behind the mirror at sides and top.
 - 4. Attached Shelf for Mirrors:
 - a. Fabricate shelf of the same material and finish as the mirror frame.
 - b. Make shelf approximately 125 mm (five inches) in depth, and extend full width of the mirror.
 - c. Close the ends and the front edge of the shelf to the same thickness as the mirror frame width.
 - d. Form shelf for aluminum framed mirror as an integral part of the bottom frame member. Form stainless steel shelf with concealed brackets to attach to mirror frame.

D. Back Plate:

1. Fabricate backplate for concealed wall hanging of either zinc-coated, or cadmium plated 0.9 mm (0.036 inch) thick sheet steel, die cut to fit face of mirror frame, and furnish with theft resistant concealed wall fastenings.
2. Use set screw type theft resistant concealed fastening system for mounting mirrors.

E. Mounting Bracket:

1. Designed to support mirror tight to wall.
2. Designed to retain mirror with concealed set screw

fastenings. **2.10 MEDICINE CABINETS**

- A. Basis-of-Design: Cygnus, Incorporated: 20" Medication Station.
- B. 20" W x 23" H x 4" D - Metal with antimicrobial powder-coated finish.
- C. Provide double panel door with lock. Provide manufacturer's full line of locks for selection.
- D. Adjustable shelf.

2.11 SHOWER SEAT

- A. Fold up shower seat.
- B. Constructed from a stainless steel frame and 5/16" (8 mm) thick solid phenolic top.
- C. Self locking mechanism.
- D. 18" wide seat, 15 13/16" projection:
- E. Mount 17"-19" to top of seat off floor.
- F. 450 lb. normal/ 1000 lb. bariatric.

2.12 MOP RACKS

- A. Minimum 1.0M (40 inches) long with five holders.
- B. Clamps:
 1. Minimum of 1.3 mm (0.050-inch) thick stainless steel bracket retaining channel with a hard rubber serrated cam; pivot mounted to channel.
 2. Clamps to hold handles from 13 mm (1/2-inch) minimum to 32 mm (1-1/4 inch) maximum diameter.
- C. Support:
 1. Minimum of 1 mm (0.0375 inch) thick stainless steel hat shape channel to hold clamps away from wall as shown.
 2. Drill wall flange for 3 mm (1/8 inch) fasteners above and below clamp locations.
- D. Secure clamps to support with oval head machine screws or rivets into continuous reinforcing back of clamps.

E. Finish on stainless Steel: AMP 503-No.

4. PART 3 - EXECUTION

3.1 PREPARATION

- A. Before starting work notify COTR in writing of any conflicts detrimental to installation or operation of units.
- B. Verify with the COTR the exact location of accessories.

3.2 INSTALLATION

- A. Set work accurately, in alignment and where shown. Items shall be plumb, level, free of rack and twist, and set parallel or perpendicular as required to line and plane of surface.
- B. Toggle bolt to steel anchorage plates in frame partitions or hollow masonry.
- C. Install accessories in accordance with the manufacturer's printed instructions and ASTM F446.
- D. Install accessories plumb and level and securely anchor to substrate.
- E. Install accessories in a manner that will permit the accessory to function as designed and allow for servicing as required without hampering or hindering the performance of other devices.
- F. Position and install dispensers, and other devices in countertops, clear of drawers, permitting ample clearance below countertop between devices, and ready access for maintenance as needed.
- G. Align mirrors, dispensers and other accessories even and level, when installed in battery.
- H. Install accessories to prevent striking by other moving, items or interference with accessibility.

3.3 CLEANING

After installation, clean as recommended by the manufacturer and protect from damage until completion of the project.

- - - E N D - - -

THIS PAGE INTENTIONALLY LEFT BLANK

SECTION 10 44 13
FIRE EXTINGUISHER CABINETS

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This section covers recessed fire extinguisher cabinets and fire extinguishers.

1.2 SUBMITTALS

- A. Submit in accordance with Section 013323, SAMPLES AND SHOP DRAWINGS.
B. Manufacturer's Literature and Data: Fire extinguisher cabinet including installation instruction and rough opening required.

PART 2 - PRODUCTS

2.1 FIRE EXTINGUISHER CABINET

- A. Semi-recessed type with 64mm (2 1/2 inch) radius rolled edge, Cosmopolitan Series 1037V17 by J.L. Industries with Cosmic 10E extinguisher.

2.2 FABRICATION

- A. Form body of cabinet from 0.9 mm (0.0359 inch) thick sheet steel.
B. Fabricate door and trim number 304 stainless steel all face joints fully welded and ground smooth.
1. Glaze doors with 6 mm (1/4 inch) thick fully tempered float glass complying with ASTM C 1048, Condition A, Type 1, Quality g3, kind FT, Class 1 (clear).
2. Design doors to open 180 degrees.
3. Provide continuous hinge, flush cup pull (ADA compliant), and adjustable roller catch.
4. Identify fire extinguisher in cabinet with FIRE EXTINGUISHER lettering applied to door. Lettering to be vertical, Black.
C. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. J.L. Industries
2. Larsen's Manufacturing Co.
3. Potter-Roemer, Inc.
4. Or approved equal

2.3 FIRE EXTINGUISHER

- A. General: Provide fire extinguisher in each cabinet shown on drawings.
B. Multipurpose Dry Chemical Type: UL-rated 4A:60B:C, 10-lb nominal capacity, in enameled steel container.

2.4 FINISH

- A. Finish interior of cabinet body with baked-on semi-gloss white enamel.

- B. Finish door and trim with manufacturer's standard number 304 stainless steel, with number 4 satin finish.

PART 3 - EXECUTION

- A. Install fire extinguisher cabinets in prepared openings and secure in accordance with manufacturer's instructions.
- B. Install cabinet so that bottom of cabinet is 991 mm (39 inches) above finished floor.

- - - E N D - - -

**SECTION 11 44 00
EQUIPMENT**

PART 1 - GENERAL

1.1 DESCRIPTION

A. This section specifies food service cooking equipment as follows:

1. Electric Fireplaces

1.2 RELATED WORK

A. Seismic Restraint of Equipment: Section 13 05 41, SEISMIC RESTRAINT REQUIREMENTS FOR NON-STRUCTURAL COMPONENTS.

B. Electrical Connections: Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS, Section 27 05 11, REQUIREMENTS FOR COMMUNICATIONS INSTALLATIONS, and Section 28 05 11, REQUIREMENTS FOR ELECTRONIC SAFETY AND SECURITY INSTALLATIONS.

C. Electrical Disconnect Switches: Section 26 29 21, DISCONNECT SWITCHES.

1.3 QUALITY CONTROL

A. Installer Qualifications: Experienced in electric fireplace installation or supervised by an electric fireplace installer.

1.4 SUBMITTALS

A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

B. Manufacturer's Literature and Data:

1. Include manufacturer's address and telephone number.
2. Include catalog or model numbers.

1.5 WARRANTY

Warrant electric fireplace to be free from defects in materials and workmanship in accordance with requirements of "Warranty of Construction", FAR clause 52.246-21.

PART 2 - PRODUCTS

2.1 BASIS OF DESIGN:

A. Hearth and Home Technologies - Simplifyre SFE-ST, See Through Electric Fireplace. Plug into 110V outlet.

- - - E N D - - -

THIS PAGE INTENTIONALLY LEFT BLANK

SECTION 11 73 00
CEILING MOUNTED PATIENT LIFT SYSTEM

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Ceiling Mounted Patient Lift Systems for the transfer of physically challenged patients are specified in this section.
- B. Included in this scope of work is the salvage and reuse of existing patient lift components with the new lifts. Coordinate with drawings for existing components to be reused. Verify that new components are compatible with existing.

1.2 RELATED WORK

- A. Section 01 00 00, GENERAL REQUIREMENTS: Requirements for pre-test of equipment.
- B. Section 13 05 41, SEISMIC RESTRAINT REQUIREMENTS FOR NON-STRUCTURAL COMPONENTS: Seismic requirements for non-structural equipment.
- C. Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS: General Electrical Requirements and items, which are common to sections of Division 26.

1.3 QUALITY ASSURANCE

Certification for compliance is required for Ceiling Mounted Patient Lift Systems. Certifications shall be provided to ensure that the ceiling lift and charging system are safe and in compliance with ISO 10535 & UL 60601-1

1.4 SUBMITTALS

- A. Submit in accordance with specification Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA AND SAMPLES.
- B. Manufacturer's Literature and Data:
 - 1. Lifting Capacity
 - 2. Lifting Speed
 - 3. Horizontal Displacement Speeds
 - 4. Horizontal Axis Motor
 - 5. Vertical Axis Motor
 - 6. Emergency Brake
 - 7. Emergency Lowering Device
 - 8. Emergency Stopping Device
 - 9. Electronic Soft-Start and Soft-Stop Motor Control
 - 10. Current Limiter for Circuit Protection
 - 11. Low Battery Disconnect System
 - 12. Strap Length

13. All equipment anchors and supports. Submittals shall include weights, dimensions, center of gravity, standard connections, manufacturer's recommendations and behavior problems (e.g., vibration, thermal expansion,) associated with equipment or piping so that the proposed installation can be properly reviewed.
- D. Individual Room layouts showing location of lift system installation shall be approved before proceeding with installation of lifts.

1.5 APPLICABLE PUBLICATIONS

- A. The publications listed below form a part of this specification to the extent referenced. The publications are listed in the text by the basic designation only.
- B. International Organization for Standardization (IOS):
10535-06Hoist for the Transfer of Disabled Persons-
Requirements and Test Methods
- C. Underwriters Laboratories (UL):
60601-1Medical Electrical Equipment: General
Requirements for Safety
94-2006 UL Standards for Safety Test for Flammability of
Plastic Materials for Parts in Devices and
Appliances-Fifth Edition
- D. International Electromagnetic Commission (IEC):
801-2(1991)Electromagnetic Compatibility for Industrial-
Process Measurement and Control Equipment-Part
2: Electromagnetic Discharge Requirements

PART 2 - PRODUCTS

2.1 CEILING TRACK SYSTEM

- A. The Ceiling Track shall be made from high strength extruded aluminum T66081-T5 at a thickness of 3/16" (4.8mm). Provide anchor supports at a minimum 3 per linear foot at ceiling substrate. The ceiling track shall be finished with baked enamel paint.
- B. Basis of Design: LIKO #3122006 - 242 ES Ceiling Mount Patient Lift, A Bariatric Lift.

2.2 LIFT UNIT

- A. The Lift Unit shall be constructed of a steel frame system (2205lbs / 1000kg tested) driven by a gear reduced high torque motor
- B. The Lift system shall have the following features.
1. Lifting capacity: 600 lbs (200 kg) / 1000 lbs (454 kg) Bariatric
 2. Electronic soft-start and soft-stop motor control

3. Emergency lowering device
4. Emergency stopping device
5. Current limiter for circuit protection in case of overload.
6. Safety device that stops the motor to lift when batteries are low.
7. Lifting speed: 2.3 in/s (5 cm/s), 1.6 in/s (3.5 cm) in full capacity
8. Horizontal displacement speed: 5.9in/s (150 mm/s)
9. Horizontal axis motor: 24VDC at 62 watts and vertical axis motor at 110 watts
10. Emergency brake (in case of mechanical failure)
11. Strap length up to 90in (2.3m) tested for 2998lbs (1360kg)
12. Cab: VO plastic-fire retardant, UL

94 2.3 MOTORS

A. Vertical Movement-DC Motor

1. Type: Class A, fully enclosed, permanent magnet.
2. Rating: 24Vdc, 1.1A, 110W, 4000RPM, 0.3N-m.
3. Mounting: Secured to chassis.

B. Horizontal Movement-DC Motor

1. Type: Fully enclosed, permanent magnet, integral reducer.
2. Rating: 24Vdc, 1.8A, 62W, 260RPM, 1.0N-m.
3. Mounting: Secured to chassis.

2.4 BATTERIES

- A. The life cycle (number of charging cycles) for batteries shall be in compliance with IEC 801-2.
- B. Provide rechargeable batteries with up to 50 transfers with its maximum load of 440lbs (200kg).

2.5 CHARGER

- A. Charger Input: 100-240 Vac, 50/60 Hz.
- B. Charger Output: 27 Vdc, 1 A max.
- C. Supplemental to the charger provide a clip on charging station with indicator lights.

2.6 STRAPS AND SLING

- A. The straps shall be made of threaded nylon. The straps shall ensure the patient's safety by preventing the patient from falling out of the sling.
- B. The sling shall be made from a polyester/nylon net material that is pliable, breathable and easy to use. The sling shall cradle the body of the patient.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install ceiling mounted patient lift system as per manufacturer's instruction and under the supervision of manufacturer's qualified representative and as shown on drawings.
- B. If the distance in between the suspended ceiling and anchors is more than 18" consult with manufacturer to determine if lateral braces will be required.

3.2 INSTRUCTION AND PERSONNEL TRAINING

Training shall be provided for the required personnel to educate them on proper operation and maintenance for the lift system equipment.

3.3 TEST

Conduct performance test, in the presence of the Resident Engineer and a manufacturer's field representative, to show that the patient lift system equipment and control devices operate properly and in accordance with design and specification requirements.

- - - E N D - - -

SECTION 12 24 00
WINDOW SHADES

PART 1 - GENERAL

1.1 DESCRIPTION

Cloth shades are specified in this section. Window shades shall be furnished complete, including brackets, fittings and hardware.

1.2 RELATED WORK

- A. Color of shade cloth and color of exposed parts of venetian blinds: Drawings
- B. Lightproof Shades: Section 09 06 00, SCHEDULE FOR FINISHES.

1.3 QUALITY CONTROL

Manufacturer's Qualification: Venetian blind and vertical blind manufacturer shall provide evidence that the manufacture of blinds are a major product, and that the blinds have performed satisfactorily on similar installations.

1.4 SUBMITTALS

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Samples:
 - 1. Shade cloth, each type, 600 mm (24 inch) square, including cord and ring, showing color, finish and texture.
- C. Manufacturer's literature and data; showing details of construction and hardware for:
 - Cloth and window shades

1.5 APPLICABLE PUBLICATIONS

- A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced to in the text by the basic designation only.
- B. Federal Specifications (Fed. Spec.):
 - AA-V-00200B Venetian Blinds, Shade, Roller, Window, Roller, Slat, Cord, and Accessories
- C. American Society for Testing and Materials (ASTM):
 - A167-99 (R2004) Stainless and heat-Resisting Chromium-Nickel Steel Plate, Sheet and Strip
 - B221/B221M-07 Aluminum-Alloy Extruded Bars, Rods, Wire, Shapes, and Tubes
 - D635-06 Rate of Burning and/or Extent and Time of Burning of Self-Supporting Plastics in a Horizontal Position

- D648-07Deflection Temperature of Plastics Under Flexural Load in the Edgewise Position
- D1784 Rev.A-06 Rigid Poly (Vinyl Chloride) (PVC) Compounds and Chlorinated Poly (Vinyl Chloride) (CPVC) Compounds

PART 2 - PRODUCTS

2.1 BASIS OF DESIGN

- A. Mechoshade Mecho/5, Double Shade #15 Bracket System with Fascia and Mechoshade Mecho/5, Single Shade System with Fascia

2.2 MATERIALS

- A. Shade Cloth: Translucent 8200 Series, room side.
- B. Blackout Shade: Opaque, against window.
- C. Staples (For Cloth Window Shades): Nonferrous metal or zinc-coated steel.
- D. Stainless Steel: ASTM A167
- E. Cords for Venetian Blinds: No. 4 braided nylon or No. 4-1/2 braided cotton having not less than 175 pounds breaking strength.
- F. Extruded Aluminum: ASTM B221/B221M.

2.3 FASTENINGS

Zinc-coated or cadmium plated metal, aluminum or stainless steel fastenings of proper length and type. Except as otherwise specified, fastenings for use with various structural materials shall be as follows:

Type of Fastening	Structural Material
Wood screw	Wood
Tap screw	Metal
Case-hardened, self-tapping screw	Sheet Metal
Screw or bolt in expansion shields	Solid masonry
Toggle bolts	Hollow blocks, wallboard and plaster

2.4 FABRICATION

- A. Fabricate cloth shades to fit measurements of finished openings obtained at site.

B. Cloth Window Shades: Rolling type, constructed of shade cloth mounted on rollers. Shade cloth shall have plain sides, and with hem at bottom to accommodate wood slat. Separate shades are required for each individual sash within opening. Length of shades shall exceed height of window approximately 300 mm (12 inches) measured from head to sill, in addition to material required to make-up hem:

1. Provide rollers with spindles, nylon bearings, tempered steel springs, and all other related accessories required for positive action. Provide rollers of diameter recommended by shade manufacturer. Staple shade cloth to wood rollers to prevent wrinkling or folding, and on line parallel to axis of rollers so that shade will hang plumb. Space staples not over 90 mm (3-1/2 inches) on centers. Use of tacks is prohibited.
2. Eyelets shall have clear openings large enough to accommodate cords. Edges of eyelets shall not cut into cloth when set.
3. Cords shall be of sufficient length to permit shades to be drawn to bottom of opening with ends looped and held with cord rings. Attach cords to hems through metal eyelets in center of slats in bottom hems.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Cloth Window Shades: Mount window shades on end of face brackets, set on metal gussets, or casing of windows as required. Provide extension face brackets where necessary at mullions.

1. Locate rollers in level position as high as practicable at heads of windows to prevent infiltration of light over rollers.
2. Where extension brackets are necessary, on mullions or elsewhere, for alignment of shades, provide metal lugs, and rigidly anchor lugs and brackets.
3. Place brackets and rollers so that shades will not interfere with window and screen hardware.
4. Shade installation methods not specifically described, are subject to approval of COTR.
5. Between (inside) Jamb Installation: Width equal to jamb-to-jamb dimension of opening in which shade is installed less 6 mm (1/4 inch) per side or 13 mm (1/2 inch) total, head-to-sill dimension of opening in which shade is installed less 6 mm (1/4 inch), plus or minus 3.1 mm (1/8 inch).

- - - E N D - - -

THIS PAGE INTENTIONALLY LEFT BLANK

SECTION 12 24 21
LIGHTPROOF SHADES

PART 1 - GENERAL

1.1 DESCRIPTION

Provide lightproof shades where indicated.

1.2 RELATED WORK

SECTION 12 24 00, WINDOW SHADES.

1.3 SUBMITTALS

- A. In accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES, furnish the following:
- B. Manufacturers' Literature and Data: Showing details of construction and hardware for Lightproof Shades.

1.4 APPLICABLE PUBLICATIONS

- A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.
- B. Federal Specifications (Fed. Spec.):
A-A-59517 Cloth, Coated or Laminated, Polyvinylchloride
(Artificial Leather)

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Shade Cloth: Fabricate for a crackproof and fadeproof material that will remain soft and pliable at all times under temperature changes. Shade cloth shall conform to fire resistant requirement of Fed. Spec. A-A59517, and shall be same color on both sides.
- B. Cords for Shades: No. 4 braided nylon, or No. 4 1/2 braided cotton having not less than 80 Kg (175 pounds) breaking strength.
- C. Fastenings: Zinc-coated or cadmium plated metal, aluminum or stainless steel fastenings of proper length and type. Except as otherwise specified, fastenings for use with various structural materials shall be as follows:

Type of Fastening	Structural Material
Wood screw	Wood
Tap Screw	Metal
Case-hardened, self-tapping screw	Solid masonry Sheet metal
Toggle bolts	Hollow blocks, wallboard plaster

2.2 FABRICATION

- A. Lightproof shades shall be metal head housing, deep side guides, sill light lock members, continuous metal jamb and head anchor section, operating bars, and shall be complete with roller assembly, one piece lightproof shade cloth, and metal disappearing type horizontal braces (two each shade).
- B. Rollers shall be of aluminum or stainless steel of sufficient diameter to support the shade, and provided with spindles, bearings and coil springs. Provide rollers with a groove and metal spline with aluminum, or stainless steel machine screws spaced not over nine inches on centers, for attaching the shade cloth.
- C. Shades not finished with a selvage shall have vertical edges bound or hemmed to prevent raveling. Sewing shall be double or triple stitched, using a high-grade thread. Make needle holes lightproof by applying a suitable filler.
- D. Stiffen the shade by transverse steel bars of size and weight to hold the shade in the channel guides. Space bars approximately 450 mm (18 inches) on centers and conceal in pockets in the shade. Fit bottom edge of the shade with a steel operating bar designed to engage the sill channel of the light trap. Paint bars with flat black enamel.
- E. Cords: Fit operating bar with pull cord.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install lightproof shades level at a height that will permit proper operation of the shades, and prevent outside light from infiltrating into the room. Shades shall not be installed until after the room painting and finishing operations are complete.
- B. Stop lightproof shade shorter, so that it drops to bottom portion of window shade bracket to hide bracket.
- C. Between (Inside) Jamb Installation: Width equal to jamb-to-jamb dimension of opening in which shade is installed less 6 mm (1/4 inch) per side or 13-mm (1/2 inch) total, plus or minus 3.1 mm (1/8 inch). Length equal to head-to-sill dimension of opening in which shade is installed less 6 mm (1/4 inch), plus or minus 3.1 mm (1/8 inch).

- E N D - -

SECTION 13 05 41
SEISMIC RESTRAINT REQUIREMENTS FOR NON-STRUCTURAL COMPONENTS

PART 1 - GENERAL

1.1 DESCRIPTION:

- A. Provide seismic restraint in accordance with the requirements of this section in order to maintain the integrity of nonstructural components of the building so that they remain safe and functional in case of seismic event.
- B. Definitions: Non-structural building components are components or systems that are not part of the building's structural system whether inside or outside, above or below grade. Non-structural components of buildings include:
 - 1. Architectural Elements: Facades that are not part of the structural system and its shear resistant elements; cornices and other architectural projections and parapets that do not function structurally; glazing; nonbearing partitions; suspended ceilings; stairs isolated from the basic structure; cabinets; bookshelves; medical equipment; and storage racks.
 - 2. Electrical Elements: Power and lighting systems; substations; switchgear and switchboards; auxiliary engine-generator sets; transfer switches; motor control centers; motor generators; selector and controller panels; fire protection and alarm systems; special life support systems; and telephone and communication systems.
 - 3. Mechanical Elements: Heating, ventilating, and air-conditioning systems; medical gas systems; plumbing systems; sprinkler systems; pneumatic systems; boiler equipment and components.
 - 4. Transportation Elements: Mechanical, electrical and structural elements for transport systems, i.e., elevators and dumbwaiters, including hoisting equipment and counterweights.

1.2 RELATED WORK:

- A. Coordinate with all other project disciplines.

1.3 QUALITY CONTROL:

- A. Shop-Drawing Preparation:
 - 1. Have seismic-force-restraint shop drawings and calculations prepared by a professional structural engineer experienced in the area of seismic force restraints. The professional structural engineer shall be registered in the state where the project is located.

2. Submit design tables and information used for the design-force levels, stamped and signed by a professional structural engineer registered in the State where project is located.

B. Coordination:

1. Do not install seismic restraints until seismic restraint submittals are approved by the Resident Engineer.
2. Coordinate and install trapezes or other multi-pipe hanger systems prior to pipe installation.

1.4 SUBMITTALS:

A. Submit a coordinated set of equipment anchorage drawings prior to installation including:

1. Description, layout, and location of items to be anchored or braced with anchorage or brace points noted and dimensioned.
2. Details of anchorage or bracing at large scale with all members, parts brackets shown, together with all connections, bolts, welds etc. clearly identified and specified.
3. Numerical value of design seismic brace loads.
4. For expansion bolts, include design load and capacity if different from those specified.

B. Submit prior to installation, a coordinated set of bracing drawings for seismic protection of piping, with data identifying the various support-to-structure connections and seismic bracing structural connections, include:

1. Single-line piping diagrams on a floor-by-floor basis. Show all suspended piping for a given floor on the same plain.
2. Type of pipe (Copper, steel, cast iron, insulated, non-insulated, etc.).
3. Pipe contents.
4. Structural framing.
5. Location of all gravity load pipe supports and spacing requirements.
6. Numerical value of gravity load reactions.
7. Location of all seismic bracing.
8. Numerical value of applied seismic brace loads.
9. Type of connection (Vertical support, vertical support with seismic brace etc.).
10. Seismic brace reaction type (tension or compression).
Details illustrating all support and bracing components, methods of connections, and specific anchors to be used.

- C. Submit prior to installation, bracing drawings for seismic protection of suspended ductwork and suspended electrical and communication cables, include:
1. Details illustrating all support and bracing components, methods of connection, and specific anchors to be used.
 2. Numerical value of applied gravity and seismic loads and seismic loads acting on support and bracing components.
 3. Maximum spacing of hangers and bracing.
 4. Seal of registered structural engineer responsible for design.
- D. Submit design calculations prepared and sealed by the registered structural engineer specified above in paragraph 1.3A.
- E. Submit for concrete anchors, the appropriate ICBC evaluation reports, OSHPD pre-approvals, or lab test reports verifying compliance with OSHPD Interpretation of Regulations 28-6.

1.5 APPLICABLE PUBLICATIONS:

- A. The Publications listed below (including amendments, addenda revisions, supplements and errata) form a part of this specification to the extent referenced. The publications are referenced in text by basic designation only.
- B. American Concrete Institute (ACI):
- 355.2-07Qualification for Post-Installed Mechanical Anchors in Concrete and Commentary
- C. American Institute of Steel Construction (AISC): Load and Resistance Factor Design, Volume 1, Second Edition.
- D. American Society for Testing and Materials (ASTM):
- A36/A36M-05 Standard Specification for Carbon Structural Steel.
- A53/A53M-07 Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.
- A307 (REV A-07) Standard Specification for Carbon Steel Bolts and Studs; 60,000 PSI Tensile Strength.
- A325-07Standard Specification for Structural Bolts, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength.
- A325M-05 Standard Specification for High-Strength Bolts for Structural Steel Joints [Metric].

- A490-06Standard Specification for Heat-Treated Steel Structural Bolts, 150 ksi Minimum Tensile Strength.
- A490M (REV A-04) Standard Specification for High-Strength Steel Bolts, Classes 10.9 and 10.9.3, for Structural Steel Joints [Metric].
- A500/A500M-07Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes.
- A501-07 Specification for Hot-Formed Welded and Seamless Carbon Steel Structural Tubing.
- A615/A615M-07 Standard Specification for Deformed and Plain Billet-Steel Bars for Concrete Reinforcement.
- A992/A992M (REV A-06) . Standard Specification for Steel for Structural Shapes for Use in Building Framing.
- A996/A996M (REV A-06) .. Standard Specification for Rail-Steel and Axel-Steel Deformed Bars for Concrete Reinforcement.
- E488-96(R2003) Standard Test Method for Strength of Anchors in Concrete and Masonry Elements.
- E. International Building Code (IBC) 2003 Edition.
- F. VA Seismic Design Requirements, H-18-8, December 2003.
- G. National Uniform Seismic Installation Guidelines (NUSIG).
- H. Sheet Metal and Air Conditioning Contractors National Association (SMACNA):
Seismic Restraint Manual - Guidelines for Mechanical Systems,
1998 Edition and Addendum.

1.6 REGULATORY REQUIREMENT:

- A. IBC 2003.
- B. Exceptions: The seismic restraint of the following items may be omitted:
1. Equipment weighing less than 400 pounds, which is supported directly on the floor or roof.
 2. Equipment weighing less than 20 pounds, which is suspended from the roof or floor or hung from a wall.
 3. Gas and medical piping less than 2 1/2 inches inside diameter.
 4. Piping in boiler plants and equipment rooms less than 1 1/4 inches inside diameter.
 5. All other piping less than 2 1/2 inches inside diameter, except for automatic fire suppression systems.

6. All piping suspended by individual hangers, 12 inches or less in length from the top of pipe to the bottom of the support for the hanger.
7. All electrical conduits, less than 2 1/2 inches inside diameter.
8. All rectangular air handling ducts less than six square feet in cross sectional area.
9. All round air handling ducts less than 28 inches in diameter.
10. All ducts suspended by hangers 12 inches or less in length from the top of the duct to the bottom of support for the hanger.

PART 2 - PRODUCTS

2.1 STEEL:

- A. Structural Steel: ASTM A36, A36M, A992.
- B. Structural Tubing: ASTM A500, Grade B.
- C. Structural Tubing: ASTM A501.
- D. Steel Pipe: ASTM A53/A53M, Grade B.
- E. Bolts & Nuts: ASTM A307, A325, A325M, A490,

A490M. 2.2 CAST-IN-PLACE CONCRETE:

- A. Concrete: 28 day strength, f'c = 25 MPa (3,000 psi)
- B. Reinforcing Steel: ASTM A615/615M or ASTM A996/A996M

deformed. PART 3 - EXECUTION

3.1 CONSTRUCTION, GENERAL:

- A. Provide equipment supports and anchoring devices to withstand the seismic design forces, so that when seismic design forces are applied, the equipment cannot displace, overturn, or become inoperable.
- B. Provide anchorages in conformance with recommendations of the equipment manufacturer and as shown on approved shop drawings and calculations.
- C. Construct seismic restraints and anchorage to allow for thermal expansion.
- D. Testing Before Final Inspection:
 1. Test 10-percent of anchors in masonry and concrete per ASTM E488, and ACI 355.2 to determine that they meet the required load capacity. If any anchor fails to meet the required load, test the next 20 consecutive anchors, which are required to have zero failure, before resuming the 10-percent testing frequency.
 2. Before scheduling Final Inspection, submit a report on this testing indicating the number and location of testing, and what anchor-loads were obtained.

3.2 EQUIPMENT RESTRAINT AND BRACING:

- A. See drawings for equipment to be restrained or braced.

3.3 MECHANICAL DUCTWORK AND PIPING; BOILER PLANT STACKS AND BREACHING; ELECTRICAL BUSWAYS, CONDUITS, AND CABLE TRAYS; AND TELECOMMUNICATION WIRES AND CABLE TRAYS

- A. Support and brace mechanical ductwork and piping; electrical busways, conduits and cable trays; and telecommunication wires and cable trays including boiler plant stacks and breeching to resist directional forces (lateral, longitudinal and vertical).
- B. Brace duct and breeching branches with a minimum of 1 brace per branch.
- C. Provide supports and anchoring so that, upon application of seismic forces, piping remains fully connected as operable systems which will not displace sufficiently to damage adjacent or connecting equipment, or building members.
- D. Seismic Restraint of Piping:
 - 1. Design criteria:
 - a. Piping resiliently supported: Restrain to support 120-percent of the weight of the systems and components and contents.
 - b. Piping not resiliently supported: Restrain to support 60-percent of the weight of the system components and contents.
 - 2. Provide seismic restraints according to one of the following options:
- E. Piping Connections: Provide flexible connections where pipes connect to equipment. Make the connections capable of accommodating relative differential movements between the pipe and equipment under conditions of earthquake shaking.

3.4 PARTITIONS

- A. In buildings with flexible structural frames, anchor partitions to only structural element, such as a floor slab, and separate such partition by a physical gap from all other structural elements.
- B. Properly anchor masonry walls to the structure for restraint, so as to carry lateral loads imposed due to earthquake along with their own weight and other lateral forces.

3.5 CEILINGS AND LIGHTING FIXTURES

- A. At regular intervals, laterally brace suspended ceilings against lateral and vertical movements, and provide with a physical separation at the walls.

3.6 FACADES AND GLAZING

- A. Do not install concrete masonry unit filler walls in a manner that can restrain the lateral deflection of the building frame. Provide a gap with adequately sized resilient filler to separate the structural frame from the non-structural filler wall.

- B. Tie brick veneers to a separate wall that is independent of the steel frame as shown on construction drawings to ensure strength against applicable seismic forces at the project location.
- C. Install attachments to structure for all façade materials as shown on construction drawings to ensure strength against applicable seismic forces at the project location.

3.7 STORAGE RACKS, CABINETS, AND BOOKCASES

- A. Install storage racks to withstand earthquake forces and anchored to the floor or laterally braced from the top to the structural elements.
- B. Anchor medical supply cabinets to the floor or walls and equip them with properly engaged, lockable latches.
- C. Anchor filing cabinets that are more than 2 drawers high to the floor or walls, and equip all drawers with properly engaged, lockable latches.
- D. Anchor bookcases that are more than 30 inches high to the floor or walls, and equip any doors with properly engaged, lockable latches.

- - - E N D - - -

THIS PAGE INTENTIONALLY LEFT BLANK

**SECTION 14 24 00
HYDRAULIC ELEVATORS**

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This section specifies the engineering, furnishing, and installation of the complete electric hydraulic elevator system as described herein and as indicated on the contract drawings.
- B. Items listed in the singular apply to each and every elevator in this specification except where noted.
- C. Passenger Elevators No. B122 #1 shall be oil hydraulic type with microprocessor based control, two stop automatic operation and power-operated single-speed side opening car and hoistway doors. Elevators shall have Class "A" loading.

1.2 RELATED WORK

- A. Section 01 33 23 SPECIFICATIONS AND DRAWINGS FOR CONSTRUCTION (FAR 52.236-21) and, SPECIAL NOTES (VAAR 852.236-91), in GENERAL CONDITIONS.
- B. Section 07 84 00, FIRESTOPPING: Sealing around penetrations to maintain the integrity of fire-rated construction.
- C. SECTION 09 06 00, SCHEDULE FOR FINISHES: As a master format for construction projects, to identify interior and exterior material finishes for type, texture, patterns, color and placement.
- D. Section 13 05 41, SEISMIC RESTRAINT REQUIREMENTS FOR NON-STRUCTURAL COMPONENTS: Requirements for seismic restraint of non-structural components.
- E. Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS: General electrical requirements that are common to more than one section.
- F. Section 26 05 21, LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES (600 VOLTS AND BELOW): Low Voltage power and lighting wiring.
- G. Section 26 05 26, GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS: Requirements for personnel safety and to provide a low impedance path for possible ground fault currents.
- H. Section 26 05 33, RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS: Conduits for cables and wiring.
- I. Section 26 05 71, ELECTRICAL SYSTEM PROTECTIVE DEVICE STUDY: Requirements for installing the over-current protective devices to ensure proper equipment and personnel protection.
- J. Section 26 22 00, LOW-VOLTAGE TRANSFORMERS: Low voltage transformers.
- K. Section 26 24 16, PANELBOARDS: Low voltage panelboards.

L. Section 26 43 13, TRANSIENT-VOLTAGE SURGE SUPPRESSION:

Surge suppressors installed in panelboards.

M. Section 26 51 00, INTERIOR LIGHTING: Fixture and ballast type for interior lighting.

N. VA Barrier Free Design Handbook (H-18-

13) 1.3 QUALIFICATIONS

A. Approval by the Contracting Officer is required for products or services of proposed manufacturers, suppliers and installers and shall be contingent upon submission by Contractor of a certificate stating the following:

1. Elevator contractor is currently and regularly engaged in the installation of elevator equipment as one of his principal products.
2. Elevator contractor shall have three years of successful experience, trained supervisory personnel, and facilities to install elevator equipment specified herein.

3. The installers shall be Certified Elevator Mechanics with technical qualifications of at least five years of successful experience and Apprentices actively pursuing certified mechanic status.

Certificates are required for all workers employed in this capacity.

4. Elevator contractor shall submit a list of two or more prior hospital installations where all the elevator equipment he proposes to furnish for this project functioned satisfactorily to serve varying hospital traffic and material handling demands. Provide a list of hospitals that have the equipment in operation for two years preceding the date of this specification. Provide the names and addresses of the Medical Centers and the names and telephone numbers of the Medical Center Administrators.

B. Approval of Elevator Contractor's equipment will be contingent upon their identifying an elevator maintenance service provider that shall render services within one hour of receipt of notification, together with certification that the quantity and quality of replacement parts stock is sufficient to warranty continued operation of the elevator installation.

C. Approval will not be given to elevator contractors and manufacturers who have established on prior projects, either government, municipal, or commercial, a record for unsatisfactory elevator installations, have failed to complete awarded contracts within the contract period, and

does not have the requisite record of satisfactorily performing elevator installations of similar type and magnitude.

- D. All hydraulic elevators shall be the product of the same manufacturer.
- E. The Contractor shall provide and install only those types of safety devices that have been subjected to tests witnessed and certified by an independent professional testing laboratory that is not a subsidiary of the firm that manufactures supplies or installs the equipment.
- F. Welding at the project site shall be made by welders and welding operators who have previously qualified by test as prescribed in American Welding Society Publications AWS D1.1 to perform the type of work required. VAMC shall require welding certificates be submitted for all workers employed in this capacity. A welding or hot work permit is required for each day and shall be obtained from the COTR of safety department. Request permit one day in advance.

1.4 APPLICABLE PUBLICATIONS

- A. The publications listed below form a part of this specification. Elevator installation shall meet the requirements of the latest editions published and adopted by the United States Department of Veterans Affairs on the date contract is signed.
- B. Federal Specifications (Fed. Spec.):
 - J-C-30B Cable and Wire, Electrical (Power, Fixed Installation)
 - W-C-596F Connector, Plug, Electrical; Connector, Receptacle, Electrical
 - W-F-406E Fittings for Cable, Power, Electrical and Conduit, Metal, Flexible
 - HH-I-558C Insulation, Blankets, Thermal (Mineral Fiber, Industrial Type)
 - W-F-408E Fittings for Conduit, Metal, Rigid (Thick- Wall and Thin-wall (EMT) Type)
 - RR-W-410 Wire Rope and Strand
 - TT-E-489J Enamel, Alkyd, Gloss, Low VOC Content
 - QQ-S-766 Steel, Stainless and Heat Resisting, Alloys, Plate, Sheet and Strip
- C. International Building Code (IBC)
- D. American Society of Mechanical Engineers (ASME):
 - A17.1 Safety Code for Elevators and Escalators

- A17.2 Inspectors Manual for Electric Elevators and Escalators
- E. National Fire Protection Association:
 NFPA 13Standard for the Installation of Sprinkler Systems
 NFPA 70National Electrical Code (NEC)
 NFPA 72National Fire Alarm and Signaling Code
 NFPA 101Life Safety Code
 NFPA 252Fire Test of Door Assemblies
- F. American Society for Testing and Materials (ASTM):
 A1008/A1008M-09 Steel, Sheet, Cold Rolled, Carbon, Structural, High-Strength Low-Alloy and High Strength Low-Alloy with Improved Farability
 E1042-02 Acoustically Absorptive Materials Applied by Trowel or Spray
- G. Manufacturer's Standardization Society of the Valve and Fittings Industry (MSS):
 SP-58 Pipe Hangers and Supports
- H. Society of Automotive Engineers, Inc. (SAE)
 J517-91 Hydraulic Hose, Standard
- I. Gages:
 For Sheet and Plate: U.S. Standard (USS)
 For Wires: American Wire Gauge (AWG)
- J. American Welding Society (AWS):
 D1.1 Structured Welding Code - Steel
- K. National Electrical Manufacturers Association (NEMA):
 LD-3 High-Pressure Decorative Laminates
- L. Underwriter's Laboratories (UL):
 486A Safety Wire Connectors for Copper Conductors
 797 Safety Electrical Metallic Tubing
- M. Institute of Electrical and Electronic Engineers (IEEE)
- N. Regulatory Standards:
 Uniform Federal Accessibility Standards
 Americans with Disabilities Act

1.5 SUBMITTALS

- A. Submit in accordance with Specification Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, and SAMPLES.
- B. Before execution of work, furnish information to evidence full compliance with contract requirements for proposed items. Such

information shall include, as required: Manufacturer's Name, Trade Names, Model or Catalog Number, Nameplate Data (size, capacity, and rating) and corresponding specification reference (Federal or project specification number and paragraph). All submitted drawings and related elevator material shall be forwarded to the Contracting Officer.

C. Shop Drawings:

1. Complete scaled and dimensioned layout in plan and section view showing the arrangement of equipment and all details of each and every elevator unit specified including:
 - a. Complete layout showing location of storage tank/pump assembly, controller, piping layout, outside diameter of cylinder/plunger assembly, size of car platform, car frame members, and support assembly.
 - b. Car, guide rails, brackets, buffers, and other components located in hoistway.
 - c. Rail bracket spacing and maximum vertical forces on guide rails in accordance with ASME A17.1 Section 2.23 and Section 8.4.8 for Seismic Risk Zone 2 or greater.
 - d. Reactions at points of supports and buffer impact loads.
 - e. Weights of principal parts.
 - f. Top and bottom clearances and over travel of the car.
 - g. Location of shunt trip circuit breaker, switchboard panel, light switch, and feeder extension points in the machine room.
2. Drawings of hoistway entrances and doors showing details of construction and method of fastening to the structural members of the building.
 - a. If drywall construction is used to enclose hoistway, submit details of interface fastenings between entrance frames and drywall.
 - b. Sill details including sill support.

D. Samples:

1. One each of stainless steel, 75 mm x 125 mm (3 in. x 5 in.).
2. One each of baked enamel, 75 mm x 125 mm (3 in. x 5 in.).
3. One each of protection pads, 75 mm x 125 mm (3 in. x 5 in.) if used.
4. One each car and hoistway Braille plate sample.
5. One each car and hall button sample.
6. One each car and hall lantern/position indicator sample.
7. One each wall and ceiling material finish sample.
8. One each car lighting sample.
9. No other samples of materials specified shall be submitted unless specifically requested after submission of manufacturer's name. If additional samples are furnished pursuant to request, adjustment in contract price and time will be made as provided in Section 00 72 00, GENERAL CONDITIONS.

1.6 WIRING DIAGRAMS

- A. Provide three complete sets of field wiring and straight line wiring diagrams showing all electrical circuits in the hoistway, machine room and fixtures. Install one set coated with an approved plastic sealer and mounted in the elevator machine room as directed by the COTR.
- B. In the event field modifications are necessary during installation, diagrams shall be revised to include all corrections made prior to and during the final inspection. Corrected diagrams shall be delivered to the COTR within 30 days of final acceptance.
- C. Provide the following information relating to the specific type of microprocessor controls installed:
 1. Owner's information manual, containing job specific data on major components, maintenance, and adjustment.
 2. System logic description.
 3. Complete wiring diagrams needed for field troubleshooting, adjustment, repair and replacement of components. Diagrams shall be base diagrams, containing all changes and additions made to the equipment during the design and construction period.
 4. Changes made during the warranty period shall be noted on the drawings in adequate time to have the finalized drawings reproduced for mounting in the machine room no later than six months prior to the expiration of the warranty period.

1.7 ADDITIONAL EQUIPMENT

- A. Additional equipment required to operate the specified equipment manufactured and supplied for this installation shall be furnished and installed by the contractor. The cost of the equipment shall be included in the base bid.
- B. Special equipment not required by specification, which would improve the operation, may be installed in conjunction with the specified equipment by the contractor at his option at no additional cost to the Government, provided prior approval is obtained from the Contracting Officer's Technical Representative.

1.8 TOOL CABINET

- A. Provide a metal parts/tool cabinet, having two shelves and hinged doors. Cabinet size shall be 1220 mm (48 in.) high, 762 mm (30 in.) wide, and 457 mm (18 in.) deep.

1.9 PERFORMANCE STANDARDS

- A. The elevators shall be capable of meeting the highest standards of the industry and specifically the following:
 - 1. Contract speed is high speed in either direction of travel with rated capacity load in the elevator. Speed variation under all load conditions, regardless of direction of travel, shall not vary more than five (5) percent.
 - 2. The controlled rate of change of acceleration and retardation of the car shall not exceed 0.1G per second and the maximum acceleration and retardation shall not exceed 0.2G per second.
 - 3. Starting, stopping, and leveling shall be smooth and comfortable without appreciable steps of acceleration and deceleration.
- B. The door operator shall open the car door and hoistway door simultaneously at 2.5-feet per second and close at 1-foot per second.
- C. Pressure: Fluid system components shall be designed and factory tested for 500 psi operating pressure.
- D. Floor level stopping accuracy shall be within 3 mm (1/8 in.) above or below the floor, regardless of load condition.
- E. Noise and Vibration Isolation: All elevator equipment including their supports and fastenings to the building, shall be mechanically and electrically isolated from the building structure to minimize objectionable noise and vibration transmission to car, building structure, or adjacent occupied areas of building.

- F. Sound Isolation: Noise level relating to elevator equipment operation in machine room shall not exceed 80 dBA. All dBA readings shall be taken three (3) feet off the floor and three (3) feet from equipment.
- G. Airborne Noise: Measured noise level of elevator equipment during operation shall not exceed 50 dBA in elevator lobbies and 60 dBA inside car under any condition including door operation and car ventilation exhaust blower on its highest speed.

1.10 WARRANTY

- A. Submit all labor and materials furnished in connection with elevator system and installation to terms of "Warranty of Construction" articles of FAR clause 52.246-21. The one year Warranty shall commence after final inspection, completion of performance test, and upon full acceptance of the installation and shall concur with the guarantee period of service.
- B. During warranty period if a device is not functioning properly or in accordance with specification requirements, or if in the opinion of the Contracting Officer's Technical Representative, excessive maintenance and attention must be employed to keep device operational, device shall be removed and a new device meeting all requirements shall be installed as part of work until satisfactory operation of installation is obtained. Period of warranty shall start anew for such parts from date of completion of each new installation performed, in accordance with foregoing requirements.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Where stainless steel is specified, it shall be corrosion resisting steel complying with Fed. Spec. QQ-S-766, Class 302 or 304, Condition A with Number 4 finish on exposed surfaces. Stainless steel shall have the grain of belting in the direction of the longest dimension and surfaces shall be smooth and without waves. During installation all stainless steel surfaces shall be protected with a suitable material.
- B. Where cold rolled steel is specified, it shall be low-carbon steel rolled to stretcher leveled standard flatness, complying with ASTM A109.

2.2 MANUFACTURED PRODUCTS

- A. Materials, devices and equipment furnished shall be of current production by manufacturers regularly engaged in the manufacture of such items. Items not meeting this requirement, but meet technical

- specifications which can be established through reliable test reports or physical examination of representative samples, will be considered.
- B. When two or more devices of the same class of materials or equipment are required, these units shall be products of one manufacturer.
 - C. Manufacturers of equipment assemblies which include components made by others shall assume complete responsibility for the final assembled unit.
 - 1. Individual components of assembled units shall be products of the same manufacturers.
 - 2. Parts which are alike shall be the product of a single manufacturer.
 - 3. Components shall be compatible with each other and with the total assembly for the intended service.
 - D. Motor nameplates shall state manufacturers' name, rated horsepower, speed, volts, amperes and other characteristics required by NEMA Standards and shall be securely attached to the item of equipment in a conspicuous location.
 - E. The elevator equipment, including controllers, door operators, and supervisory system shall be non-proprietary, the product of manufacturers of established reputation, provided such items are capably engineered and produced under coordinated specifications to ensure compatibility with the total operating system. Mixing of manufactures related to a single system or group of components shall be identified in the submittals.
 - F. Where key operated switches are furnished in conjunction with any component of this elevator installation, furnish four (4) keys for each individual switch or lock. Provide different key tumblers for different switch and lock functions. Each and every key shall have a tag bearing a stamped or etched legend identifying its purpose. Barrel key switches are not acceptable, except where required by code. Fire key for ASME A17.1.
 - G. If the elevator equipment to be installed is not known to the COTR, the Contractor shall submit drawings in triplicate for approval to the COTR, Contracting Officer, and VA CFM Elevator Engineer showing all details and demonstrate that the equipment to be installed is in strict accordance with the specifications.
 - H. Basis-of-Design: Otis

2.3 CAPACITY, SIZE, SPEED, AND TRAVEL

- A. Each direct-plunger elevator shall have the capacity to lift the live load, including the weight of entire car and plunger, at the speed specified in the following schedule:

ELEVATOR SCHEDULE	
Elevator Number	B122 #1
Overall Platform Size	5'-11" min. x 8'-6" min.
Rated Load - kg(lb)	5000 lbs.
Contract Speed - m/s(fpm)	125 fpm.
Total Travel - m/s(fpm)	125 fpm.
Number of Stops	2
Number of Openings	2
Entrance Type & Size	
Plunger Size	

2.4 POWER SUPPLY

- A. For power supply in each machine room see Specification 260521, ELECTRICAL SPECIFICATION and Electrical drawings.
- B. It shall be the electrical contractor's responsibility to supply the labor and materials for the installation of the following:
1. Feeders from the power source indicated on the drawings to each elevator controller.
 2. Shunt Trip Circuit Breaker for each controller shall be located inside machine room at the strike side of the machine room door and lockable in the "Off" position.
 3. Provide Surge Suppressors to protect the elevator equipment.
- C. Power for auxiliary operation of elevator as specified shall be available from auxiliary power generator, including wiring connection to the elevator control system.

2.5 CONDUIT AND WIREWAY

- A. Unless otherwise specified or approved, install electrical conductors, except traveling cable connections to the car, in rigid zinc-coated steel or aluminum conduit, electrical metallic tubing or metal wireways. Rigid conduit smaller than 3/4 inch or electrical metallic tubing smaller than 1/2 inch electrical trade size shall not be used. All raceways completely embedded in concrete slabs, walls, or floor

fill shall be rigid steel conduit. Wireway (duct) shall be used in the hoistway and to the controller and between similar apparatus in the elevator machine room. Fully protect self-supporting connections, where approved, from abrasion or other mechanical injury. Flexible metal conduit not less than 3/8 inch electrical trade size may be used, not exceeding 18 inches in length unsupported, for short connections between risers and limit switches, interlocks, and for other applications permitted by NEC.

- B. All conduit terminating in steel cabinets, junction boxes, wireways, switch boxes, outlet boxes and similar locations shall have approved insulation bushings. Install a steel lock nut under the bushings if they are constructed completely of insulating materials. Protect the conductors at ends of conduits not terminating in steel cabinets or boxes by terminal fittings having an insulated opening for the conductors.
- C. Rigid conduit and EMT fittings using set screws or indentations as a means of attachment shall not be used. All fittings shall be steel or malleable iron.
- D. Connect motors or other items subject to movement, vibration or removal to the conduit or EMT systems with flexible, steel conduits.

2.6 CONDUCTORS

- A. Unless otherwise specified, conductors, excluding the traveling cables, shall be stranded or solid coated annealed copper in accordance with Federal Specification J-C-30B for Type RHW or THW. Where 16 and 18 AWG are permitted by NEC, single conductors or multiple conductor cables in accordance with Federal Specification J-C-580 for Type TF may be used provided the insulation of single conductor cable and outer jacket of multiple conductor cable is flame retardant and moisture resistant. Multiple conductor cable shall have color or number coding for each conductor. Conductors for control boards shall be in accordance with NEC. Joints or splices are not permitted in wiring except at outlets. Tap connectors may be used in wireways provided they meet all UL requirements.
- B. Provide all necessary conduit and wiring between machine room and hoistway.
- C. All wiring must test free from short circuits or ground faults. Insulation resistance between individual external conductors and between conductors and ground shall be a minimum of one megohm.

- D. Where size of conductors is not given, voltage and amperes shall not exceed limits prescribed by NEC.
- E. Provide equipment grounding. Ground the conduits, supports, controller enclosure, motor, platform and car frame, and all other non-current conducting metal enclosures for electrical equipment in accordance with NEC. The ground wires shall be copper, green insulated and sized as required by NEC. Bond the grounding wires to all junction boxes, cabinets, and wire raceways.
- F. Terminal connections for all conductors used for external wiring between various items of elevator equipment shall be solderless pressure wire connectors in accordance with Federal Specification W-S-610. The Elevator Contractor may, at his option, make these terminal connections on 10 gauge or smaller conductors with approved terminal eyelets set on the conductor with a special setting tool, or with an approved pressure type terminal block. Terminal blocks using pierce-through serrated washers are not acceptable.

2.7 TRAVELING CABLES

- A. All conductors to the car shall consist of flexible traveling cables conforming to the requirements of NEC. Traveling cables shall run from the junction box on the car directly to the controller. Junction boxes on the car shall be equipped with terminal blocks. Terminal blocks having pressure wire connectors of the clamp type that meet UL 486A requirements for stranded wire may be used in lieu of terminal eyelet connections. Terminal blocks shall have permanent indelible identifying numbers for each connection. Cables shall be securely anchored to avoid strain on individual terminal connections. Flame and moisture resistant outer covering must remain intact between junction boxes. Abrupt bending, twisting and distortion of the cables shall not be permitted.
- B. Provide spare conductors equal to 10 percent of the total number of conductors furnished, but not less than 5 spare conductors in each traveling cable.
- C. Provide shielded wires for the auto dial telephone system within the traveling cable. Add 5 pair shielded wires for card reader, 2 RG-6/U coaxial CCTV cables, and 2 pair 14 gauge wires for CCTV power as needed.
- D. If traveling cables come into contact with the hoistway or elevator due to sway or change in position, provide shields or pads to the elevator and hoistway to prevent damage to the traveling cables.

05-11

- E. Hardware cloth wide may be 14 24 00-13 installed from the hoistway

suspension point downward to the elevator pit to prevent traveling cables from rubbing or chafing. Hardware cloth shall be securely fastened and tensioned to prevent buckling. Hardware cloth is not required when traveling cable is hung against a flat wall.

2.8 CONTROLLER AND SUPERVISORY PANEL

- A. UL/CSA Labeled Controller: Mount all assemblies, power supplies, chassis switches, and relays on a self-supporting steel frame. Completely enclose the equipment and provide a mean to control the temperature. Solid state components shall be designed to operate between 32 to 104 degrees Fahrenheit, humidity non-condensing up to 85 percent.
- B. All controller switches and relays shall have contacts of design and material to insure maximum conductivity, long life and reliable operation without overheating or excessive wear, and shall provide a wiping action to prevent sticking due to fusion. Switches carrying highly inductive currents shall be provided with arc shields or suppressors.
- C. Where time delay relays are used in the circuits, they shall be of acceptable design, adjustable, reliable, and consistent such as condenser timing or electronic timing circuits.
- D. Properly identify each device on all panels by name, letter, or standard symbol which shall be neatly stencil painted or decaled in an indelible and legible manner. Identification markings shall be coordinated with identical markings used on wiring diagrams. The ampere rating shall be marked adjacent to all fuse holders. All spare conductors to controller and supervisory panel shall be neatly formed, laced, and identified.

2.9 MICROPROCESSOR CONTROL SYSTEM

- A. Provide a microprocessor based system with absolute position/speed feedback encoded tape and electronic motor starter to control the pump motor and signal functions in accordance with these specifications. Across the line and wye-delta starters are not acceptable. Complete details of the components and printed circuit boards, together with a complete operational description, shall be submitted for approval.
 - 1. All controllers shall be non-proprietary.
 - 2. Proprietary tools shall not be necessary for adjusting, maintenance, repair, and testing of equipment.

3. Controller manufacturer shall provide factory training, engineering and technical support, including all manuals and wiring diagrams to the VA Medical Center's designated Elevator Maintenance Service Provider.
 4. Replacement parts shall be shipped overnight within 48 hours of an order being received.
- B. All controller assemblies shall provide smooth, step-less acceleration and deceleration of the elevator, automatically and irrespective of the load in the car. All control equipment shall be enclosed in a metal cabinet with lockable, hinged door(s) and shall be provided with a means of ventilation. All non-conducting metal parts in the machine room shall be grounded in accordance with NEC. Cabinet shall be securely attached to the building structure.
- C. Circuit boards for the control of each and every elevator system; dispatching, signals, door operation and special operation shall be installed in a NEMA Type 1 General Purpose Enclosure. Circuit boards shall be moisture resistant, non-corrosive, non-conductive, fabricated of non-combustible material and adequate thickness to support the components mounted thereon. Mounting racks shall be spaced to prevent accidental contact between individual circuit boards and modules.
- D. Modules shall be of the type that plug into pre-wired mounting racks. Field wiring or alteration shall not be necessary in order to replace defective modules.
- E. Each device, module and fuse (with volt and ampere rating) shall be identified by name, letter or standard symbol in an approved indelible and legible manner on the device or panel. Coordinate identification markings with identical markings on wiring diagrams.
- F. The electrical connections between the printed circuit boards (modules) and the circuit connectors incorporated in the mounting racks shall be made through individual tabs which shall be an integral part of each module. The tabs shall be nickel-gold plated or other approved metal of equal electrical characteristics. Modules shall be keyed or notched to prevent insertion of the modules in the inverted position.
- G. Light emitting diodes (LED) shall be for visual monitoring of individual modules.
- H. Components shall have interlocking circuits to assure fail-safe operation and to prevent elevator movement should a component malfunction.

- I. Method of wire wrapping from point to point with connections on the mounting racks shall be submitted for approval.
- J. Field wiring changes required during construction shall be made only to the mounting rack connection points and not to the individual module circuitry or components. If it is necessary to alter individual modules they shall be returned to the factory where design changes shall be made and module design records changed so correct replacement units will be available.
- K. All logic symbols and circuitry designations shall be in accordance with ASME and NEC Standards.
- L. Solid state components shall be designed to operate within a temperature range of 32 to 104 degrees Fahrenheit, humidity non-condensing up to 85 percent.
- M. Wiring connections for operating circuits and for external control circuits shall be brought to terminal blocks mounted in an accessible location within the controller cabinet. Terminal blocks using pierce through serrated washers shall not be used.

2.10A AUXILIARY POWER OPERATION

- A. The control system for Elevator shall provide for the operation of auxiliary power upon failure of the normal power supply.
- B. Auxiliary equipment on elevator controllers, wiring between associated elevator controllers and wiring between elevator controllers and remote selector panel as required to permit the elevators to operate as detailed, shall be provided by the Elevator Contractor.
- C. Upon loss of normal power supply there shall be a delay before transferring to auxiliary power of 10 seconds minimum to 45 seconds maximum, the delay shall be accomplished through an adjustable timing device. Following this adjustable delay the associated elevators shall function as follows:
- D. Prior to the return of normal power an adjustable timed circuit shall be activated that will cause all cars to remain at a floor if already there or stop and remain at the next floor if in flight. Actual transfer of power from auxiliary power to normal building power shall take place after all cars are stopped at a floor with their doors open.
- E. Car lighting circuits shall be connected to the auxiliary power panel.

2.10B EMERGENCY RESCUE OPERATION

- A. Provide a power source to send the elevator to the lowest landing by activating the down valves. After the elevator has leveled at the lowest landing, provide power to open the car and hoistway doors automatically. After a predetermined time the car and hoistway doors shall close. Power shall stay applied to the door open button so the doors can be opened from the inside of the elevator. The elevator shall remain shut down at the bottom landing until normal power is restored.

2.11A TWO-STOP AUTOMATIC OPERATION

- A. Provide two-stop automatic operation for passenger elevator P____.
- B. Design system so that when the car is standing at either terminal landing, pressing on car button for the other terminal landing shall automatically dispatch car to that landing. Pressing a call button at either landing shall call the car automatically to that landing. If a call is registered while the car is making its trip that call shall remain registered until the car responds to that call. Provide time limit relay arranged to hold car at landing at which it has stopped for predetermined time after car stops. After all car and hall calls have been answered, car shall remain parked at landing where last used with car and hoistway doors closed, until another call is registered.
- C. Pressing the call button at the floor at which car is parked shall automatically open car and hoistway doors.
- D. Car lights and fan in the elevator shall not shut off when elevator is idle. Arrange circuits so that power to lights and outlets on top and bottom of car shall not be interrupted.

2.11B SINGLE CAR SELECTIVE COLLECTIVE AUTOMATIC OPERATION

- A. Provide single car selective collective automatic operation for passenger elevators P____.
- B. Operate car without attendant from push buttons inside the car and located at each floor adjacent to the elevator entrance. When car is available, automatically start car and dispatch it to the floor corresponding to registered car or hall call. Once car starts, it shall respond to registered calls in direction of travel in the order floors are reached. Do not reverse car directions until all car calls have been answered or until all hall calls ahead of car and corresponding to direction of car travel have been answered. Slow car and stop automatically at floors corresponding to registered calls, in the order in which they are approached in either direction of travel. As

slowdown is initiated, automatically cancel the hall call and car call. Hold car at arrival floor an adjustable time interval to allow passenger transfer. Illuminate appropriate push button to indicate call registration. Extinguish light when call is answered.

- C. When all calls in the system have been satisfied, the elevator shall shut down at the last landing served with the car and hoistway doors closed. Registration of a call at the landing where the car is parked shall automatically open the car and hoistway doors. Provide a predetermined time delay to permit passengers entering the parked car to register the call of their choice and establish direction of travel before the system can respond to landing calls registered to the same time above or below the parked car.

2.12 FIREFIGHTERS' SERVICE

- A. Provide Firefighters' Service as per ASME A17.1 Section 2.27.
- B. Smoke Detectors:
 - 1. Smoke detection devices that are designated for actuation of Elevator Phase I "FIRE SERVICE" response in each elevator lobby, top of hoistway, and machine room shall be provided by others.
 - a. Elevator lobby smoke detectors shall activate only the elevators sharing the corresponding or common lobby.
 - b. Top of hoistway smoke detectors shall activate fire recall and the top of hoistway motorized vent.
 - c. Elevator or group of elevators serving separate isolated areas of the same floor shall have an independent smoke detection system.
 - d. Machine room smoke detectors shall activate fire recall for each and every elevator with equipment located in that machine room.
 - e. Hoistway ventilation, provided by others, located at the top of hoistway for elevators that penetrate more than three floors and meets the requirements of ASME A17.1 Section 2.1.4 and IBC Section 3004. The vent shall stay closed under power. When the top of hoistway smoke detector is activated, the power is removed from the vent and the vent shall open. When the smoke detector is reset, the vent shall close by power.
 - f. Coordinate with VA and Specification Section 28 31 00 'Fire Detection and Alarm' for approved Shunt Trip Operation detail.

2.13 MEDICAL EMERGENCY SERVICE

- A. Provisions shall be made for calling elevator on "Medical Emergency" operating independently from the dispatch signals and landing call signals. Provide a two-position, key-operated, momentary contact, spring return switch at both floors.
- B. Install key switch in the floor landing push button fixture above the push buttons.
- C. Landing key switches shall be momentary pressure-spring return to "OFF" position. Provide a call registered light indicator adjacent to key switch. The landing key switch and the "Medical Emergency" key switch in the car shall not be operable by keys used for any other purpose in the hospital.
- D. When switch is activated at any floor, the call register light indicator shall illuminate at that floor only, and the elevator supervisory control system shall instantly select the nearest available elevator in service to respond to the medical emergency call. Immediately upon selection, all car calls within that car shall be cancelled. Transfer any landing calls which had previously been assigned that car to another car. If the selected car is traveling away from the medical emergency call, it shall slow down and stop at the nearest floor, maintain closed doors, reverse direction and proceed nonstop to the medical emergency call floor. If the selected car is traveling toward the medical emergency call floor, it shall proceed to that floor nonstop. If at the time of selection it is slowing down for a stop, the car shall stop, maintain doors closed, and start immediately toward the medical emergency floor.
- E. Arriving at the medical emergency floor, the car shall remain with doors open for 30 seconds. After this interval has expired and the car has not been placed on medical emergency operation from within the car, the car shall automatically return to normal service.
 1. Locate a "Medical Emergency" key switch in the upper section of each main car operating panel for selecting medical emergency service. Activation of the key switch will allow the car to accept a car call for any floor, close doors, and proceed nonstop to the floor desired. The return of the key switch to normal position will restore the car to normal service. The key shall be removable only in the off position.

- F. Any car in the group which is in group service may be selected. Additional medical emergency calls, as they are registered in the system, shall cause additional cars to respond as described below, always on the basis of one medical emergency call per car.
- G. Provide an LED illuminated indicator light next to the Medical Emergency key switch the same size as the Fire Service indicator. In the center of the rear cab panel provide a back lighted "MEDICAL EMERGENCY" LED illuminated display that shall flash on and off continuously when the car is assigned to this operation and until it is restored to normal service. "MEDICAL EMERGENCY" indicator shall be a photographic negative type 1830 mm (72 in.) to center above the floor, 152 mm (6 in.) wide X 76 mm (3 in.) high, with 12 mm (1/2 in.) high letters legible only when illuminated.
- H. All of the key switches in the "Medical Emergency" system for each and every elevator shall operate from the same key. The medical emergency call service key shall not operate any other key switch in the elevator system, nor shall any other key required by the elevator system be able to operate the medical emergency call service switches.
- I. Should all the cars be operating on "Independent Service", the medical emergency service indicator lights in the car operating panel and rear wall shall be illuminated, buzzer shall sound, and the "Audio Voice" system shall direct the attendant to return the car to automatic operation.
- J. Should all the cars be out of service and unable to answer medical emergency calls, the call register light shall not illuminate.
- K. Each switch faceplate shall have legible indelible legends engraved or etched to indicate its identity and positions. All letters in faceplates shall be 6 mm (1/4 in.) high, filled with black paint.
- L. When Phase I fire recall is activated it shall over-ride elevators on medical emergency service and return them to the main or alternate fire service recall floor. When the fire emergency floor has been identified the attendants may complete their medical emergency run on Phase II firefighters' operation if life safety is not affected.
- M. Provide four (4) keys for each "Medical Emergency" key cylinder furnished.

2.14 SEISMIC REQUIREMENTS

- A. Meet the requirements of ASME A17.1 Section 8.4, Elevator Safety Requirements for Seismic Risk Zone 2 or greater and VA Seismic Design Manual H-18-8.
- B. Support and maintain pump unit, controller, rails, rail brackets, conduit, buffers, piping, scavenger pumps and jack unit assembly in place as to effectively prevent any part from sliding, rotating or overturning or jumping under conditions imposed by seismic forces not less than that required to produce an acceleration of gravity horizontally and 1/2 gravity vertically acting simultaneously. Design the total system to continue operation without interruption under specified seismic acceleration, as outlined in H-18-8.
- C. Support all vertical conduits and duct systems within the hoistway at points above the center of gravity of riser. Provide lateral guides at regular intervals.
- D. Provide hydraulic equipment mounted on vibration isolators with seismic restraints.
- E. Bolt pump unit and controller to the floor and provide sway braces at top. Secure all electrical components within the panels to the panel frame. Fit doors and hinged panels with positive locking latches.
- F. Car guide rail brackets and rail clip bolts shall be guarded against snagging on the side of the rail adjacent to the point of suspension of the traveling cables.
- G. Provide car guide rails with at least one intermediate bracket between brackets located at each floor so that bracket spacing does not exceed 2400 mm (8 ft). If intermediate brackets cannot be installed because of lack of structural support, reinforce rails with 225 mm (9 in.) channel or approved equal backing.
- H. Guide rails shall not be less than 22.5 kg/m (15 lb/ft).
- I. The stresses in parts of structural members made of steel shall not exceed 88 percent of the minimum elastic strength of the material used in the fastenings.
- J. Provide car enclosure ceiling panels and fluorescent tubes with latching devices that shall restrain the panels and fluorescent tubes. Devices shall be readily removable for cleaning or replacing panels and re-lamping.

2.15 PUMP UNIT ASSEMBLY

- A. Completely integrate the pump unit for the control of the elevator and self-contain in a unit fabricated of structural steel. The unit shall consist of a hydraulic fluid pump driven by an induction motor together with oil control valves, piping, etc.
- B. Control valves shall be electronically controlled. Hydraulic fluid flow shall be controlled to insure speed variation of not more than five (5) percent under all load conditions.
- C. Hydraulic system working pressure shall not exceed 500 psi under any load condition.
- D. Pump shall be positive displacement, rotary screw type, specifically designed for hydraulic elevator service, having a steady discharge without pulsation to give smooth and quiet operation. Pump output shall be capable of lifting elevator car with rated capacity, with a speed variation of no more than five (5) percent between no load and full load. Pump shall operate under flooded suction in an accurately machined case with the clearance required to assure maximum efficiency. Hydraulic fluid by-pass shall discharge directly into storage tank.
- E. Motor shall be squirrel-cage, drip proof, ball bearing, and induction type, with a synchronous speed not in excess of 1800 RPM. Design motor specifically for elevator service, not to exceed nameplate full load current by more than 10% and be continuously rated 120 starts per hour without exceeding a rise of 40 degrees C. Include closed transition SCR soft start.
- F. Hydraulic equipment may be installed within the oil storage tank if applicable for elevator size, speed, and duty rating.
- G. Design motor, pump, tank, and piping to accommodate future travel, if specified.

2.16 HYDRAULIC SYSTEM

- A. Construct the storage tank of sheet steel, welded construction, and a steel cover with suitable means for filling, a minimum one-inch protected vent opening, an overflow connection, and a valve drain connection. Tank shall act as a storage tank only, and sized to pass through machine room door as shown on drawings. Provide marked gauge to monitor hydraulic fluid level. Tank shall be of capacity to hold volume of hydraulic fluid required to lift elevator to top terminal landing, plus a reserve of not less than ten gallons. Provide a baffle in the bottom of the tank to prevent entry of any sediment or foreign

particles into hydraulic system. Baffle shall also minimize aeration of hydraulic fluid. Permissible minimum hydraulic fluid level shall be clearly indicated. Hydraulic fluid shall be of good grade to assure free flow when cool, and have minimum flash point of 400 degrees F. Provide initial supply of hydraulic fluid for operation of elevator.

1. Thermostatically control the viscosity of the hydraulic fluid with thermal cooling unit and temperature thermostat to maintain the fluid temperature in the reservoir, pump and valves at a constant operating viscosity.
 2. Provide a data plate on the tank framing indicating the characteristics of the hydraulic fluid used.
- B. Furnish and install connections between the storage tank, pump, muffler, operating valves, and cylinder complete with necessary valves, pipe supports, and fittings. All connections between the discharge side of the pump, check valve, muffler, cylinder, lowering valves shall be of schedule 40 steel with threaded, flanged, or welded mechanical couplings. Size of pipe and couplings between cylinder and pumping unit shall be such that fluid pressure loss is limited to 10 percent.
- C. Do not subject valves, piping, and fittings to working pressure greater than those recommended by the manufacturer.
- D. Support all horizontal piping. Place hangers or supports within 305 mm (12 in.) on each side of every change of direction of pipe line and space supports not over 3.0 meters (10 ft) apart. Secure vertical runs properly with iron clamps at sufficiently close intervals to carry weight of pipe and contents. Provide supports under pipe to floor.
1. Provide all piping from machine room to hoistway, including necessary supports or hangers. If remote piping is underground or in damp inaccessible areas, install hydraulic piping thru PVC sleeve pipe.
- E. Install pipe sleeves where pipes pass through walls or floors. Set sleeves during construction. After installation of piping, equip the sleeves with snug fitting inner liner of either glass or mineral wool insulation.
- F. Install blowout-proof, non-hammering, oil-hydraulic muffler in the hydraulic fluid supply pressure line near power unit in machine room. Design muffler to reduce to a minimum any pulsation or noises that may be transmitted through the hydraulic fluid into the hoistway.

- G. Arrange control valves to operate so hydraulic fluid flow will be controlled in positive and gradual manner to insure smooth starting and stopping of elevator.
- H. Provide safety check valve between cylinder and pump connection which will hold elevator with specified load at any point when pump stops or pressure drops below minimum operating levels.
- I. Provide an automatic shut-off valve in the oil supply line at the cylinder inlet. Weld pipe protruding from cylinder at inlet and thread to receive shut-off valve. Activate the automatic shut-off valve when there is more than a ten percent increase in high speed in the down direction. When activated, this device shall immediately stop the descent of the elevator, and hold the elevator until it is lowered by use of the manual lowering feature of the valve. Arrange the manual lowering feature of the automatic shut-off valve to limit the maximum descending speed of the elevator to 15 fpm. The exposed adjustments of the automatic shut-off valve shall have their means of adjustment sealed after being set to their correct position.
- J. Provide external tank shut-off valve to isolate hydraulic fluid during maintenance operations.
- K. Provide all pump relief and other auxiliary valves to comply with the requirements of the ASME A17.1 Section 3.19 and to insure smooth, safe, and satisfactory operation of elevator.
- L. Furnish and adjust by-pass and relief valve in accordance with ASME A17.1 Rule 3.19.4.2.
- M. Install check valve to hold the elevator car with rated load at any point when the pump stops.
- N. Provide shut-off valves in the pit near the cylinder and in the machine room capable of withstanding 150 percent of design operating pressure. Each manual valve shall have an attached handle.
- O. Conveniently locate the manual lowering valve, easily accessible, and properly identified with a red arrow and not concealed within the storage tank. Mark the operating handle in red.
- P. Provide a low oil control feature which shall shut off the motor and pump and return the elevator to the lowest landing. Upon reaching the lowest landing, doors will open automatically allowing passengers to leave the car. Then doors shall close. All control buttons, except the door open button, shall be made ineffective.

- Q. Provide oil-tight drip pan for assembled pumping unit, including storage tank.
- R. The entire hydraulic system, including muffler, shall be tested to withstand a pressure equal to twice the calculated working pressure. Submit certification that test has been performed.

2.17 HYDRAULIC PLUNGER ASSEMBLY

- A. Design cylinder and plunger in accordance with ASME A17.1. It shall be of sufficient size to lift gross load the height specified. Factory test at a pressure equal to twice the calculated working pressure, for strength and to insure freedom from leakage. Provide bottom of cylinder head with internal guide bearing and top of cylinder head with removable packing gland. Packing gland shall permit ready replacement of packing. Victaulic type packing gland head will not be permitted.
 - 1. Provide a bleeder valve located below the cylinder flange to release air or other gases from the system.
 - 2. Equip cylinder with drip ring below the packing gland to collect leakage of hydraulic fluid.
 - 3. Bolt the cylinder mounting brackets to continuous footing channels that also support the rails and buffers.
- B. Plunger shall be heavy seamless steel tubing, turned smooth and true to within plus or minus .38 mm (0.015 in.) tolerance and no diameter change greater than .07 mm (0.003in.) per-inch of length. Grind the plunger surface to a fine polish finish, 12 micro-inches or finer. Where plunger is multi-piece construction, machine the joints to assure perfectly matching surfaces. No tool marks shall be visible.
 - 1. Secure plunger to underside of platform supporting beams with fastenings capable of supporting four times the weight of the plunger. The platen plate shall incorporate piston car vibration isolator as herein specified.
 - 2. Provide a stop ring welded or screwed to the bottom of plunger that shall prevent the plunger from leaving its cylinder.
 - 3. Carefully protect plunger and replace if gouged, nicked or scored.
 - 4. If conditions beneath the pit floor are not adequate to support the total loading of the elevator, install reinforcing members in the pit floor.
- C. Before installation, clean entire cylinder wall of all traces of oil, grease, moisture, dirt and scale.

COTR2.18 CAR BUFFERS

- A. Provide a minimum of two spring buffers for each elevator that meet the requirements of ASME A17.1 Section 3.22. Securely fasten buffers and supports to the pit channels and in the alignment with striker plates on elevator. Ever installed buffer shall have a permanently attached metal plate indicating its stroke and load rating. Buffer anchorage shall not puncture pit waterproofing.
- B. Design and install buffers to provide minimum car runby required by ASME A17.1 Rule 3.4.2.
- C. Furnish pipe stanchions and struts as required to properly support the buffer.

2.20 CAR GUIDES

- A. Install on car frame four flexible sliding swivel guide shoes or adjustable roller guides, each assembled on a substantial metal base, to permit individual self-alignment to the guide rails.
- B. Guide Shoes:
 - 1. Provide each shoe with renewable non-metallic gibs of durable material having low coefficient of friction and long-wearing qualities, when operated on guide rails receiving infrequent, light applications of rail lubricant. Gibs containing graphite or other solid lubricants are not acceptable.
 - 2. Guide shoes of approved design, other than swivel type, may be used provided they are self-aligning on all three faces of the guide rails.
- C. Equip car with an auxiliary guiding device for each guide shoe which shall prevent the car from leaving the rails in the event that the normal guides are fractured. These auxiliary guides shall not, during normal operation, touch the guiding surfaces of the rails. Fabricate the auxiliary guides from hot rolled steel plate and mount between the normal guide shoes and the car frames. The auxiliary guides may be an extension of the normal guide shoe mounting plate if that plate is fabricated from hot rolled steel. The portion of the auxiliary guide which shall come in contact with the rail guiding surfaces in the event of loss of the normal guides shall be lined with an approved bearing material to minimize damage to the rail guiding surfaces.

2.21 GUIDE RAILS, SUPPORTS, AND FASTENINGS

- A. Guide rails shall conform to ASME A17.1 Section 2.23.
- B. Guide rails for car shall be planed steel T-sections.

- C. Securely fasten guide rails to the brackets or other supports by heavy duty steel rail clips.
- D. Provide necessary car rail brackets of sufficient size and design to secure substantial rigidity to prevent spreading or distortion of rails under any condition.
 - 1. Slotted or oversized holes shall be fitted with flat washers and shall conform to ASME A17.1 Rule 2.23.10.3.
 - 2. Where fastenings are over 4.2 m (14 ft) apart, rails shall be reinforced with 228 mm (9 in.) channel or approved equal backing to secure the rigidity required.
- E. Rail joints and fishplates shall be in accordance with ASME A17.1 Rule 2.23.7. Rail joints shall not interfere with clamps and brackets. Design rail alignment shims to remain in place if fastenings become loose.
- F. Guide rails shall extend from channels on pit floor to within 76 mm (3 in.) of the underside of the concrete slab or grating at top of hoistway with a maximum deviation of 3.2 mm (1/8 in.) from plumb in all directions. Provide a minimum of 19 mm (3/4 in.) clearance between bottom of rails and top of pit channels.
- G. Guide rail anchorages in pit shall be made in a manner that will not reduce effectiveness of the pit waterproofing.
- H. In the event inserts or bond blocks are required for the attachment of guide rails, the Contractor shall furnish such inserts or bond blocks and shall install them in the forms before the concrete is poured. Use inserts or bond blocks only in concrete or block work where steel framing is not available for support of guide rails. Expansion-type bolting for guide rail brackets will not be permitted.
- I. Guide rails shall be clean and free of any signs of rust, grease, or abrasion before final inspection. Paint the shank and base of the T-section with two field coats of manufacturer's standard enamel. 2.22

NORMAL AND FINAL TERMINAL STOPPING DEVICES

- A. Normal and final terminal stopping devices shall conform to ASME A17.1 Section 2.25.
- B. Mount terminal slowdown switches and direction limit switches on the elevator or in hoistway to reduce speed and bring car to an automatic stop at the terminal landings.

1. Switches shall function with any load up to and including 100 percent of rated elevator capacity at any speed obtained in normal operation.
 2. Switches, when opened, shall permit operation of elevator in reverse direction of travel.
- C. Mount final terminal stopping switches in the hoistway.
1. Switches shall be positively opened should the car travel beyond the terminal direction limit switches.
 2. Switches shall be independent of other stopping devices.
 3. Switches, when opened, shall remove power from pump motor and control valves preventing operation of car in either direction.
- D. After final stopping switches have been adjusted, through bolt switches to guide rail.

2.23 CROSSHEAD DATA PLATE AND CODE DATA PLATE

- A. Permanently attach a non-corrosive metal Data Plate to car crosshead. Data plate shall bear information required by ASME A17.1 Section 2.16.3 and 2.20.2.1.
- B. Permanently attach a Code Data Plate, in plain view, to the controller, ASME A17.1 Section 8.9.

2.24 WORKMAN'S LIGHTS AND OUTLETS

- A. Provide duplex GFCI protected type receptacles and lamp, with guards on top of elevator car.
- B. The receptacles shall be in accordance with Fed. Spec. W-C-596 for Type D7, 2-pole, 3-wire grounded type rated for 15 amperes and 125 volts.

2.25 TOP-OF-CAR OPERATING DEVICE

- A. Provide a cartop operating device that meets the requirements of ASME A17.1 Section 2.26.
- B. The device shall be activated by a toggle switch mounted in the device. The switch shall be clearly marked "INSPECTION" and "NORMAL" on the faceplate, with 6 mm (1/4 in.) letters.
- C. Movement of the elevator shall be accomplished by the continuous pressure on a direction button and a safety button.
- D. Provide an emergency stop toggle type switch.
- E. Provide permanent identification for the operation of all components in the device.
- F. The device shall be permanently attached to the elevator crosshead on the side of the elevator nearest to the hoistway doors used for accessing the top of the car.

05-11

2.26 CAR LEVELING DEVICE

14 24 00-28

- A. Car shall be equipped with a two-way leveling device to automatically bring the car to within 3 mm (1/8 in.) of exact level with the landing for which a stop is initiated regardless of load in car or direction.
- B. If the car stops short or travels beyond the floor, the leveling device, within its zone shall automatically correct this condition and maintain the car within 3 mm (1/8 in.) of level with the floor landing regardless of the load carried.
- C. Provide encoded steel tape, steel tape with magnets or steel vanes with magnetic switches. Submit design for approval.

2.27 EMERGENCY STOP SWITCHES

- A. Provide an emergency stop switch for each top-of-car device, pit, machine spaces, service panel and firefighters' control panel inside the elevator. Mount stop switches in the pit adjacent to pit access door, at top of the pit ladder 1220 mm (48 in.) above the bottom landing sill and 1220 mm (48 in.) above the pit floor adjacent to the pit ladder.
- B. Each stop switch shall be red in color and shall have "STOP" and "RUN" positions legibly and indelibly identified.

2.28 MAIN CAR OPERATING PANEL

- A. Locate the main car operating panel in the car enclosure on the front return panel for passenger/service elevators and the front of the side wall for freight elevators. The top floor car call push button shall not be more than 1220 mm (48 in.) above the finished floor. Car call push buttons and indicator lights shall be round with a minimum diameter of 25 mm (1 in.), LED white light illuminated.
- B. One piece front faceplate, with edges beveled 15 degrees, shall have the firefighters' service panel recessed into the upper section and the service operation panel recessed into the lower section, fitted with hinged doors. Doors shall have concealed hinges, be in the same front plane as the faceplate and fitted with cylinder type key operated locks. Secure the faceplate with stainless steel tamperproof screws.
- C. All terminology on the main car operating panel shall be raised or engraved. Use 6 mm (1/4 in.) letters to identify all devices in upper section of the main car operating panel. The handicapped markings with contrasting background shall be recessed .030 inch in the faceplate, square or rectangular in shape, with the finished face of the 12 mm

(1/2 in.) numerals and markings flush with the faceplates. Surface mounted plates are not acceptable.

D. The upper section shall contain the following items in order listed from top to bottom:

1. Engrave capacity plate information with black paint for contrast with freight loading class and number of passengers allowed.
2. Emergency car lighting system consisting of a rechargeable battery, charger, controls, and LED illuminated light fixture. The system shall automatically provide emergency light in the car upon failure or interruption of the normal car lighting service, and function irrespective of the position of the light control switch in the car. The system shall be capable of maintaining a minimum illumination of 1.0 foot-candle when measured 1220 mm (48 in.) above the car floor and approximately 305 mm (12 in.) in front of the car operating panel, for not less than four (4) hours.
3. LED illuminated digital car position indicator with direction arrows. Digital display floor numbers and direction arrows shall be a minimum of 50mm (2 in.) high.
4. Firefighters' Emergency Operation Panel shall conform to the requirements of ASME A17.1 Section 2.27. Firefighters' Panel shall be 1676 mm (66 in.) minimum to 1830 mm (72 in.) maximum to the top of the panel above finished floor.
5. Firefighters' Emergency Indicator Light shall be round with a minimum diameter of 25 mm (1 in.).
6. Medical Emergency switch marked "MEDICAL EMERGENCY" with two positions labeled "ON" and "OFF" and Medical Emergency Indicator Light located next to the key switch shall be round with a minimum diameter of 25 mm (1 in.). Instruction for Medical Emergency operation shall be engraved below the key switch and light.
7. Independent Service switch, see Section 2.30 for detailed description.
8. Provide a Door Hold button on the faceplate next to the independent service key switch. It shall have "DOOR HOLD" indelibly marked on the button. Button shall light when activated. When activated, the door shall stay open for a maximum of one minute. To override door hold timer, push a car call button or door close button. Door Hold button is not ADA required and Braille is not needed.

9. Complete set of round car call push buttons, minimum diameter of 25 mm (1 in.), and LED white light illuminated, corresponding to the floors served. Car call buttons shall be legibly and indelibly identified by a floor number and/or letter not less than 12mm (1/2 in.) high in the face of the call button. Stack buttons in a single vertical column for low rise buildings up to six floors with front openings only.
 10. Door Open and Door Close buttons shall be located below the car call buttons. They shall have "OPEN" and "CLOSE" legibly and indelibly identified by letters in the face of the respective button. The Door Open button shall be located closest to the door jamb as required by ADA.
 11. Red Emergency Alarm button that shall be located below the car operating buttons. Mount the emergency alarm button not lower than 890 mm (35 in.) above the finished floor. It shall be connected to audible signaling devices as required by A17.1 Rule 2.27.1.2. Provide audible signaling devices including the necessary wiring.
 12. Emergency Help push button shall activate two way communications by Auto Dial telephone system as required by ASME A17.1 Rule 2.27.1.1.3. Help button shall be LED white light illuminated and flash when call is acknowledged. Legibly and indelibly label the button "HELP" in the face of the button with 12 mm (1/2 in.) high letters.
 13. Provide a corresponding Braille plate on the left side of each button. The handicapped markings with contrasting background shall be recessed .030 inch in the faceplate, square or rectangular in shape, with the finished face of the 12 mm (1/2 in.) numerals and markings flush with the faceplates. Surface mounted plates are not acceptable.
- E. The service operation panel, in the lower section shall contain the following items:
1. Light switch labeled "LIGHTS" for controlling interior car lighting with its two positions marked "ON" and "OFF".
 2. Inspection switch that will disconnect normal operation and activate hoistway access switches at terminal landings. Switch shall be labeled "INSPECTION" with its two positions marked "ON" and "OFF".
 3. Three position switch labeled "FAN" with its positions marked "HIGH", "LOW" and "OFF" for controlling car ventilating blower.

4. Two position, spring return, toggle switch or push button to test the emergency light and alarm device. It shall be labeled "TEST EMERGENCY LIGHT AND ALARM".
5. Two position emergency stop switch, when operated, shall interrupt power supply and stop the elevator independently of regular operating devices. Emergency stop switch shall be marked "PULL TO STOP" and "PUSH TO RUN".

2.29 INDEPENDENT SERVICE

- A. Provide a legibly and indelibly labeled "INDEPENDENT SERVICE", two-position key operated switch on the face of the main car operating panel that shall have its positions marked "ON" and "OFF". When the switch is in the "ON" position, the car shall respond only to calls registered on its car dispatch buttons and shall bypass all calls registered on landing push buttons. The car shall start when a car call is registered, car call button or door close button is pressed, car and hoistway doors are closed, and interlock circuits are made. When switch is returned to "OFF" position, normal service shall be resumed.

2.30 CAR POSITION INDICATOR

- A. Provide an alpha-numeric digital car position indicator in the main car operating panel, consisting of numerals and arrows not less than 50 mm (2 in.) high, to indicate position of car and direction of car travel. Locate position indicator at the top of the main car operating panel, illuminated by light emitting diodes.

2.31 AUDIO VOICE SYSTEM

- A. Provide digitized audio voice system activated by stopping at a floor. Audio voice shall announce floor designations, direction of travel, and special announcements. The voice announcement system shall be a natural sounding human voice that receives messages and shall comply with ADA requirements for audible car position indicators. The voice announcer shall have two separate volume controls, one for the floor designations and direction of travel, and another for special announcements. The voice announcer shall have a full range loud speaker, located on top of the cab. The audio voice unit shall contain the number of ports necessary to accommodate the number of floors, direction messages, and special announcements. Install voice announcer per manufacturer's recommendations and instructions. The voice announcer units shall be the product of a manufacturer of established reputation. Provide manufacturer literature and list of voice messages.

1. Fire Service Message
2. Medical Emergency Service Message
3. "Please do not block doors."
4. Provide special messages as directed by

COTR. 2.32 AUTO DIAL TELEPHONE SYSTEM

- A. Furnish and install a complete ADA compliant intercommunication system.
- B. Provide a two-way communication device in the car with automatic dialing, tracking and recall features with shielded wiring to car controller in machine room. Provide dialer with automatic rollover capability with minimum two numbers.
- C. "HELP" button shall illuminate and flash when call is acknowledged. Button shall match floor push button design.
- D. Provide "HELP" button tactile symbol engraved signage and Braille adjacent to button mounted integral with car operating panels.
- E. The auto dial system shall be located in the auxiliary car operating panel. The speaker and unit shall be mounted on the backside of the perforated stainless steel plate cover.
- F. Each elevator shall have an individual phone number.
- G. If the operator ends the call, the phone shall be able to redial immediately.

2.33 CORRIDOR OPERATING DEVICE FACEPLATES

- A. Fabricate faceplates for elevator operating and signal devices from not less than 3 mm (1/8 in.) thick flat stainless steel with all edges beveled 15 degrees. Install all faceplates flush with surface on which they are mounted.
- B. Corridor push button faceplates shall be at least 127 mm (5 in.) wide by 305 mm (12 in.) high. The centerline of the landing push buttons shall be 1067 mm (42 in.) above the corridor floor.
- C. Elevator Corridor Call Station Pictograph shall be engraved in the faceplate.
- D. Fasten all car and corridor operating device and signal device faceplates with stainless steel tamperproof screws.
- E. Design corridor push button faceplates so that pressure on push buttons shall be independent of pressure on push button contacts.
- F. Engraved legends in faceplates shall have lettering 6 mm (1/4 in.) high filled with black paint.
- G. Provide a corresponding Braille plate on the left side of each button. The handicapped markings with contrasting background shall be recessed

05-11

.030 inch in the faceplate, square or rectangular in

14 24 00-33

shape, with the finished face of the 12 mm (1/2 in.) numerals and markings flush with the faceplates. Surface mounted plates are not acceptable.

2.34 CORRIDOR OPERATING DEVICES

- A. Provide one riser of landing call buttons rated for exterior exposure located as shown on contract drawings.
- B. Fixtures for intermediate landings shall contain "UP" or "DOWN" buttons. Fixtures for terminal landings shall contain a single "UP" or "DOWN" button.
- C. Each button shall contain an integral registration LED white light which shall illuminate upon registration of a call and shall extinguish when that call is answered.
- D. The direction of each button shall be legibly and indelibly identified by arrows not less than 12 mm (1/2 in.) high in the face of each button.
- E. Landing push buttons shall not re-open the doors while the car and hoistway doors are closing at that floor, the call shall be registered for the next available elevator. Calls registered shall be canceled if closing doors are re-opened by means of "DOOR OPEN" button or infrared curtain unit.

2.35 HOISTWAY ACCESS SWITCHES

- A. Provide hoistway access switches for elevator at top terminal landing to permit access to top of car. Exposed portions of each access switch or its faceplate shall have legible, indelible legends to indicate "UP", "DOWN", and "OFF" positions. Submit design and location of access switches for approval. Each access switch shall be a constant pressure cylinder type lock having not less than five pins or five stainless steel disc combination with key removable only when switch is in the "OFF" position. Lock shall not be operable by any other key which will operate any other lock or device used for any other purpose in the VA Medical Center. When the car is moved down from the top terminal landing, limit the zone of travel to a distance not greater than the top of the crosshead level with the top floor.
- B. Provide emergency access for all hoistway entrances, keyways for passenger and service elevators and locked door release system (key access) for freight elevators.

2.36 HOISTWAY ENTRANCES: PASSENGER/SERVICE ELEVATORS

- A. Provide exterior rated entrances of metal construction using cold rolled steel. Door frames shall be constructed of stainless steel. Complete entrances with sills, hanger supports, hangers, tracks, angle struts, unit frames, door panels, fascia plates, toe guards, hardware, bumpers, sight guards, and wall anchors.
- B. Provide one piece extruded stainless steel sills with non-slip wearing surface, grooved for door guides and recessed for fascia plates. Sills shall have overall height of not less than 19 mm (3/4 in.) set true, straight, and level, with hoistway edges plumb over each other, and top surfaces flush with finished floor. Grout the sills full length after installation.
- C. Construct hanger supports of not less than 4.5 mm (3/16 in.) thick steel plate, and bolted to strut angles.
- D. Structural steel angles 127 mm x 127 mm x 13 mm (5 in. x 5 in. x 1/2 in.) shall extend from top of sill to bottom of floor beam above, and shall be securely fastened at maximum 457 mm (18 in.) on center and at each end with two bolts.
- E. Provide jambs and head soffits, of not less than 14-gauge stainless steel, for entrances. Jambs and head soffits shall be bolted or welded construction, and provided with three anchors each side. Side jambs shall be curved type. Radius of curvature shall be 89 mm (3 1/2 in.). Head jamb shall be square type, and shall overhang corridor face of side jambs by 6 mm (1/4 in.). Rigidly fasten jambs and head soffits to building structure. Provide jambs with protective covering. After installation, protect jambs and head soffits to prevent damage to finish during construction. Solidly grout jambs.
- F. Provide 14-gauge sheet steel fascia plates in hoistway to extend vertically from head of hanger support housing to sill above. Plates shall be the same width as the door opening of elevator and adequately reinforced to prevent waves and buckles. Below bottom terminal landing and over upper terminal landing provide shear guards beveled back to and fastened to the wall.
- G. Provide hoistway entrance with flush two speed slide hoistway doors for Elevator. Door panels shall be not less than 16-gauge stainless steel, flush type construction, and not less than 32 mm (1 1/4 in.) thick. Wrap stainless steel around the leading and trailing edges of the door panel. Top and bottom of door panels shall have continuous stiffener

channels welded in place. Reinforcement of the door panels shall be approximately 1.0 mm (0.04 in.) in thickness and of the hat section type. At bottom of each and every panel, provide two removable laminated phenolic gibs or other approved material guides and a separate fire gib. Reinforce each door panel for hangers, interlock mechanism, drive assembly, and closer. One door panel for each entrance shall bear a BOCA label, Underwriters' label, or in lieu of this, labels from other accredited test laboratories may be furnished provided they are based on fire test reports and factory inspection procedures acceptable to the COTR. Fasten sight guard of 14-gauge stainless steel, extending full height of panel, to leading edge of each panel of center opening doors.

- H. Provide hangers for hoistway door panels and provide relating devices to transmit motion from one door panel to the other. Fasten the hangers to the door sections. Provide reinforcements at the point of attachment. The hanger shall have provisions for vertical and lateral adjustments. Hang doors on two-point suspension hangers having sealed ball-bearing sheaves not less than 76 mm (3 in.) in diameter, with rubber or non-metallic sound-reducing tires mounted on malleable iron or steel brackets. The hanger sheaves shall operate at a relatively low rotational speed, and shall roll on a high-carbon, cold-rolled or drawn steel track shaped to permit free movement of sheaves without regard to vertical adjustment of sheave, bracket or housing. Beneath the track and each hanger sheave, provide a hardened steel up-thrust roller capable of withstanding a vertical thrust equal to the carrying capacity of adjacent upper sheave. The up-thrust shall have fine vertical adjustments, and the face of the roller shaped so as to permit free movement of the hanger sheave. The up-thrust roller shall have ball or roller bearings. Provide the hanger sheaves with steel fire stops to prevent disengagement from tracks.
- I. Do not use hangers that are constructed integrally with the door panels.
- J. Provide raised numerals on cast, rear mounted plates for all openings. Numerals shall be a minimum of 50 mm (2 in.) high, located on each side of entrance frame, with centerline of 1524 mm (5 ft) above the landing sill. The number plates shall contain Braille.
- K. Provide unique car number on every elevator entrance at designated main fire service floor level, minimum 76 mm (3 in.) in height.

2.39 ELECTRIC INTERLOCKS

- A. Equip each hoistway door with an interlock, functioning as hoistway unit system, to prevent operation of car until all hoistway doors are locked in closed position. Hoistway door interlocks shall not be accepted unless they meet the requirements of ASME A17.1 Section 2.12.
- B. Equip car doors with electric contact that prevents operation of car until doors are closed unless car is operating in leveling zone or hoistway access switch is used. Locate door contact to prevent its being tampered with from inside of car. Car door contact shall not be accepted unless it meets the requirements of ASME A17.1 Section 2.12.
- C. Wiring installed from the hoistway riser to each door interlock shall be NEC type SF-2, or equivalent.
 - 1. Type SF-2 cable terminations in the interlock housing shall be sleeved with glass braid fillers or equivalent.
- D. Provide devices, either mechanical or electrical, that shall prevent operation of the elevator in event of damaged or defective door equipment that has permitted an independent car or hoistway door panel to remain in the "unclosed" and "unlocked" position.

2.40 CAR FRAME: PASSENGER/SERVICE ELEVATORS

- A. Car frame shall conform to the requirements of ASME A17.1 Section 2.15, constructed of steel plates and structural shapes securely riveted, bolted, or welded together. Iron casting shall not be permitted. The entire assembly shall be rugged construction, and amply braced to withstand unequal loading of platform. Car frame members shall be constructed to relieve the car enclosure of all strains. Balance car front to back and side to side. Provide balancing weights and frames, properly located, to achieve the required true balance.
- B. Provide a bonding wire between frame and plunger.

2.41 CAR PLATFORM: PASSENGER/SERVICE ELEVATORS

- A. Construct the car platform to comply with all the requirements of ASME A17.1 Section 2.15.5. The platform shall be designed to withstand the forces developed under the loading conditions specified. Provide car entrances with extruded nickel silver sill or better with machined or extruded guide grooves. Cover underside and all exposed edges of wood filled platform with sheet metal of not less than 27-gauge, with all exposed joints and edges folded under. Fire resistant paint is not acceptable. Platform shall have flexible composition flooring not less than 3 mm (1/8 in.) thick. For color, see Section 09 06 00, SCHEDULE

FOR FINISHES. Adhesive material shall be type recommended by manufacturer of flooring. Lay flooring flush with threshold plate and base.

- B. Provide a platform guard (toe guard) that meets the requirements of ASME A17.1 Section 2.15.9, of not less than 12-gauge sheet-steel on the entrance side, extend 76 mm (3 in.) beyond each side of entrance jamb. Securely brace platform guard to car platform, and bevel bottom edge at a 60-75 degree angle from horizontal. Install platform in the hoistway, so that the clearance between front edge and landing threshold shall not exceed 32 mm (1 1/4 in.).
- C. Isolate the platform from the car frame by approved rubber pads or other equally effective means.
- D. Provide adjustable diagonal brace rods to hold platform firmly within car suspension frame.
- E. Provide a bonding wire between frame and platform.

2.42 CAR ENCLOSURE: PASSENGER/SERVICE ELEVATORS

- A. Car enclosure shall have a dome height inside the cab of 2440 mm (8 ft).
- B. Securely fasten car enclosure to platform by through bolts located at intervals of not more than 457 mm (18 in.) running through an angle at the base of panels to underside of platform. Provide 6 mm (1/4 in.) bolts with nuts and lock washers.
- C. Car enclosure base shall be of 14-gauge stainless steel, 152 mm (6 in.) high. Provide straight type base at front return sides. Vertical face of base at sides and rear shall be flush with, or recessed behind the wainscot directly above the base. There shall be no exposed fastenings in base. Provide natural ventilation openings divided equally between the bottom and top of the car enclosure that shall provide a minimum 3.5 percent of the inside car floor area.
- D. Construct canopy of not less than 12-gauge steel.
- E. Car top railings shall meet the requirements of ASME A17.1 Rules 2.14.1.7 and 2.10.2.
- F. Front return wall panel, entrance columns, rear corner columns, entrance head-jamb and transom shall be 14-gauge stainless steel full height of car. Side and rear walls from top of base to top of panel shall be constructed of 14-gauge cold rolled steel. Side and rear walls up to 1220 mm (48 in.) above finished floor shall be covered with

- stainless steel. Side and rear walls from 1220 (48 in.) to the ceiling shall be covered with stainless steel.
- G. Provide a hinged top emergency exit cover. Exit shall be unobstructed when open and shall have mechanical stops on the cover. Provide a code approved exit switch to prevent operation of the elevator when the emergency exit is open.
- H. Provide duplex, GFCI protected type receptacle in car. Locate flush-mounted receptacle on the centerline of the main car operating panel, 150 mm (6 in.) above the car floor.
- I. Lighting for passenger elevators:
1. Provide stainless steel hanging ceiling frame. Construct frame of 1/8 in. x 1 1/2 in. x 1 1/2 in. "T" and "L" sections, divide ceiling into six panels.
 2. Provide fluorescent or LED illuminated car light fixtures above the ceiling panels. See Specification 265100, Interior Lighting for fixture and ballast type. Maintain a minimum light level of 50-foot candles at 914 mm (36 in.) above the finished floor.
- J. Provide a blower unit arranged to exhaust through an opening in the canopy. Provide a stainless or chrome plated fan grill around the opening. Provide 2-speed fan, capable of rated free delivery air displacement of approximately 380 and 700 cfm at respective speeds. Mount fan on top of car with rubber isolation to prevent transmission of vibration to car structure. Provide screening over intake and exhaust end of blower. Provide a 3-position switch to control the unit in service panel.
- K. Provide car enclosure with two sets of stainless steel handrails.
1. 75 mm (3 in.) wide x 9 mm (3/8 in.) thick flatstock located with centerlines 750 mm and 1050 mm (30 in. and 42 in.) above the car floor.
 2. Locate handrails approximately 38 mm (1 1/2 in.) from cab wall. Install handrails on two side and rear walls. Curve ends of handrails to walls. Conceal all handrail fastenings. Handrails shall be removable from inside the car enclosure.
- L. Provide car entrance with two speed side opening horizontal sliding car doors, of same type as hoistway doors for Elevator P. Construct door panels to be flush hollow metal construction, not less than 32 mm (1 1/4 in.) thick, consisting of one continuous piece 16-gauge stainless steel on car side face, leading and trailing edges. Separate two

plates by a sound-deadening material, and reinforce by steel shapes welded to the plates at frequent intervals. Reinforce panels as required for installation of hangers, power-operating and door-opening devices. Hang doors on two-point suspension hangers having sealed ball-bearing sheaves not less than 76 mm (3 in.) in diameter, with rubber or non-metallic sound-reducing tires. Equip hangers with adjustable ball-bearing rollers to take upward thrust of panels. Upthrust rollers shall be capable of being locked in position after adjustment to a maximum of .38 mm (1/64 in.) clearance. Provide two laminated phenolic gibs on each door panel. Gibs shall be replaceable without removal of door panel. Provide door drive assembly, restrictor, gate switch, header, track, arms, and all related door hardware.

2.43 POWER DOOR OPERATORS: PASSENGER/SERVICE ELEVATORS

- A. Provide a high-speed heavy duty door operator to automatically open the car and hoistway doors simultaneously when the car is level with the floor, and automatically close the doors simultaneously at the expiration of the door-open time. Provide solid-state door control with closed loop circuitry to constantly monitor and automatically adjust door operation based upon velocity, position, and motor current. Motor shall be of the high-internal resistance type, capable of withstanding high currents resulting from stall without damage to the motor. The door operator shall be capable of opening a car door and hoistway door simultaneously, at a speed of .762 m (2.5 ft) per second. The closing speed of the doors shall be .3 m (1 ft) per second. A reversal of direction of the doors from the closing to opening operation, whether initiated by obstruction of the infrared curtain or the door "OPEN" button, shall be accomplished within 38 mm (1.5 in.) maximum of door movement. Emphasis is placed on obtaining quiet interlock and door operation; smooth, fast, dynamic braking for door reversals, stopping of the door reversal, and stopping of the doors at extremes of travel. Construct all levers and drive arms operating the doors, of heavy steel members, and all pivot points shall have ball or roller bearings. Auxiliary automatic door closers required under ASME A17.1 Section 2.11.3 shall be torsion spring type.
- B. Should the doors be prevented from closing for more than a predetermined adjustable interval of 20 to 60 seconds by operation of the curtain unit, the doors shall stay open, the audio voice message

and a buzzer located on the car shall sound only on automatic operation.

1. If an obstruction of the doors should not activate the photo-electric door control device and prevent the doors from closing for more than a predetermined adjustable interval of 15 to 30 seconds, the doors shall reverse to the fully open position and remain open until the "Door Close" button re-establishes the closing cycle.
- C. Provide door "OPEN" and "CLOSE" buttons. When the door "OPEN" button is pressed and held, the doors, if in the open position, shall remain open and if the doors are closing, they shall stop, reverse and re-open. Momentary pressure of the door "CLOSE" button shall initiate the closing of the doors prior to the expiration of the normal door open time.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Examine work of other trades on which the work of this Section depends. Report defects to the COTR in writing which may affect the work of this trade or equipment operation dimensions from site for preparation of shop drawings.
- B. Ensure that shafts and openings for moving equipment are plumb, level and in line, and that pit is to proper depth, waterproofed and drained with necessary access doors, ladder and guard.
- C. Ensure that machine room is properly illuminated, heated and ventilated, and equipment, foundations, beams correctly located complete with floor and access stairs and door.
- D. Before fabrication, take necessary job site measurements, and verify where work is governed by other trades. Check measurement of space for equipment, and means of access for installation and operation. Obtain dimensions from site for preparation of shop drawings.
- E. Ensure the following preparatory work, provided under other sections of the specification has been provided. If the Elevator Contractor requires changes in size or location of trolley beams, or their supports, trap doors, etc., to accomplish their work, he must make arrangements, subject to approval of the Contracting officer and include cost in their bid. Where applicable, locate controller near and visible to its respective hydraulic pump unit. Work required prior to the completion of the elevator installation:

1. Supply of electric feeder wires to the terminals of the elevator control panel, including circuit breaker.
 2. Provide light and GFCI outlets in the elevator and machine room pit per ASME A17.1.
 3. Furnish electric power for testing and adjusting elevator equipment.
 4. Furnish circuit breaker panel in machine room for car and hoistway lights and receptacles.
 5. Supply power for cab lighting and ventilation from an emergency power panel specified in Division 26, ELECTRICAL.
 6. Machine room enclosed and protected from moisture, with self closing, self locking door and access stairs.
 7. Provide fire extinguisher in machine room.
- F. Supply for installation, inserts, anchors, bearing plates, brackets, supports and bracing including all setting templates and diagrams for placement.

3.2 SPACE CONDITIONS

- A. Attention is called to overhead clearance, pit clearances, overall space in machine room, and construction conditions at building site in connection with elevator work. Addition or revision of space requirements, or construction changes that may be required for the complete installation of the elevators must be arranged for and obtained by the Contractor, subject to approval by COTR. Include cost of changes in bid that become a part of the contract. Provide proper, code legal installation of equipment, including all construction, accessories and devices in connecting with elevator, mechanical and electrical work specified.
- B. Where concrete beams, floor slabs or other building construction protrude more than 50 mm (2 in.) into hoistway; bevel all top surfaces of projections to an angle of 75 degrees with the horizontal.

3.3 INSTALLATION

- A. Perform work with competent Certified Elevator Mechanics and Apprentices skilled in this work and under the direct supervision of the Elevator Contractor's experienced foreman.
- B. Set hoistway entrances in alignment with car openings, and true with plumb sill lines.
- C. Erect hoistway sills, headers and frames prior to erection of rough walls and doors. Erect fascias and toe guards after rough walls are finished.

- D. Install machinery, guides, controls, car and all equipment and accessories in accordance with manufacturer's instructions, applicable codes and standards.
- E. Isolate and dampen machine vibration with properly sized sound-reducing anti-vibration pads.
- F. Grout sills and hoistway entrance frames.

3.4 ARRANGEMENT OF EQUIPMENT

- A. Clearance around elevator, mechanical and electrical equipment shall comply with applicable provisions of NEC. Arrange equipment in machine room so that major equipment components can be removed for repair or replacement without dismantling or removing other equipment in the same machine room. Locate controller near and visible to its respective hydraulic pump unit.

3.5 WORKMANSHIP AND PROTECTION

- A. Installations shall be performed by Certified Elevator Mechanics and Apprentices to best possible industry standards. Details of the installation shall be mechanically and electrically correct. Materials and equipment shall be new and without imperfections.
- B. Recesses, cutouts, slots, holes, patching, grouting, refinishing to accommodate installation of equipment shall be included in the Contractor's work. All new holes in concrete shall be core drilled.
- C. Structural members shall not be cut or altered. Work in place that is damaged or defaced shall be restored equal to original condition.
- D. Finished work shall be straight, plumb, level, and square with smooth surfaces and lines. All machinery and equipment shall be protected against dirt, water, or mechanical injury. At final completion, all work shall be thoroughly cleaned and delivered in perfect unblemished condition.
- E. Sleeves for conduit and other small holes shall project 50 mm (2 in.) above concrete slabs.
- F. Exposed gears, sprockets, and sheaves shall be guarded from accidental contact in accordance with ASME A17.1 Section 2.10.

3.6 CLEANING

- A. Clean machine room and equipment.
- B. Perform hoistway clean down.
- C. Prior to final acceptance, remove protective covering from finished or ornamental surfaces. Clean and polish surfaces with regard to type of material.

3.7 PAINTING AND FINISHING

- A. Hydraulic pump assembly shall be factory painted with manufacturer's standard finish and color.
- B. Controllers, car frames and platforms, beams, rails and buffers, except their machined surfaces, cams, brackets and all other uncoated ferrous metal items shall be painted one factory priming coat or approved equal.
- C. Upon completion of installation and prior to final inspection, all equipment shall be thoroughly cleaned of grease, oil, cement, plaster and other debris. All equipment, except that otherwise specified as to architectural finish, shall then be given two coats of paint of approved color, conforming to manufacturer's standard.
- D. Stencil or apply decal floor designations not less than 100 mm (4 in.) high on hoistway doors, fascias or walls within door restrictor areas as required by ASME A17.1 Rule 2.29.2. The color of paint used shall contrast with the color of the surfaces to which it is applied.
- E. Elevator pump units, controllers, main line shunt trip circuit breakers, bolster channels, and cross heads of cars shall be identified by 100 mm (4 in.) high numerals and letters located as directed. Numerals shall contrast with surrounding color and shall be stenciled or decaled.
- F. Hoistway Entrances of Passenger, and Service Elevators:
 - 1. Door panels shall be parkerized or given equivalent rust resistant treatment and a factory finish of one coat of baked-on primer and one factory finish coat of baked-on enamel.
 - 2. Fascia plates, top and bottom shear guards, dust covers, hanger covers, and other metalwork, including built-in or hidden work and structural metal, (except stainless steel entrance frames and surfaces to receive baked enamel finish) shall be given one approved prime coat in the shop, and one field coat of paint of approved color.
- G. Elevator Cabs for Passenger Elevators:
 - 1. Interior steel surfaces shall be factory finished with one coat of baked on enamel or proxylin lacquer. For color, see Section 09 06 00, SCHEDULE FOR FINISHES.
 - 2. Give exterior faces of car doors one finish coat of paint of medium gray color.

3.8 PRE-TESTS AND TESTS

- A. Pre-test the elevators and related equipment in the presence of the COTR or his authorized representative for proper operation before requesting final inspection. Conduct final inspection at other than normal working hours, if required by COTR.
1. Procedure outlined in the Inspectors Manual for Hydraulic Elevators, ASME A17.2 shall apply.
 - a. Final test shall be conducted in the presence of and witnessed by an ASME QEI-1 Certified Elevator Inspector.
 - b. Government shall furnish electric power including necessary current for starting, testing, and operating machinery of each elevator.
 2. Contractor shall furnish the following test instruments and materials on-site and at the designated time of inspection: properly marked test weights, oil pressure gauge, voltmeter, amp probe, thermometers, direct reading tachometer, megohm meter, vibration meter, sound meter, light meter, stop watch, and a means of two-way communication.
 3. If during the inspection process the Inspector determines the need, the following instruments shall be available within a four-hour period: Megohm meter, vibration meter, sound meter, and a light meter.
- B. Inspection of workmanship, equipment furnished, and installation for compliance with specification.
- C. Full-Load Run Test: Elevators shall be tested for a period of one hour continuous run with full contract load in the car. The test run shall consist of the elevator stopping at all floors, in either direction of travel, for not less than five or more than ten seconds per floor.
- D. Speed Test: The actual speed of the elevator shall be determined in both directions of travel with full contract load and no load in the elevator. Speed shall be determined by certified tachometer. The actual measured speed of the elevator with all loads in either direction shall be within five (5) percent of specified rated speed. Full speed runs shall be quiet and free from vibration and sway.
- E. Temperature Rise Test: The temperature rise of the pump motor shall be determined during the full load test run. Temperatures shall be measured by the use of thermometers. Under these conditions, the temperature rise of the equipment shall not exceed 50 degrees

- Centigrade above ambient temperature. Test shall start when all machine room equipment is within 5 degrees Centigrade of the ambient temperature. Other tests for heat runs on motors shall be performed as prescribed by the Institute of Electrical and Electronic Engineers.
- F. Car Leveling Test: Elevator car leveling devices shall be tested for accuracy of leveling at all floors with no load in car and with contract load in car in both directions of travel. Accuracy of floor level shall be within plus or minus 3 mm (1/8 in.) of level with any landing floor for which the stop has been initiated regardless of load in car or direction of travel. The car leveling device shall automatically correct over travel as well as under travel and shall maintain the car floor within plus or minus 3 mm (1/8 in.) of level with the landing floor regardless of change in load.
- G. Insulation Resistance Test: The elevator's complete wiring system shall be free from short circuits and ground faults and the insulation resistance of the system shall be determined by use of megohm meter, at the discretion of the Elevator Inspector conducting the test.
- H. Safety Devices Tests: Safety devices shall be tested as required by ASME A17.1 Section 8.10.
- I. Overload Devices: Test all overload current protection devices in the system at final inspection.
- J. Limit Stops:
1. The position of the car when stopped by each of the normal limit stops with no load and with contract load in the car shall be accurately measured.
 2. Final position of the elevator relative to the terminal landings shall be determined when the elevator has been stopped by the final limits. The lower limit stop shall be made with contract load in the elevator. Elevator shall be operated at inspection speed for both tests. Normal limit stopping devices shall be inoperative for the tests.
- K. Working Pressure: Verify working pressure of the hydraulic system by pressure gauge placed in the system line. Take readings with no load and full load in car.
- L. Test automatic shut-off valve for proper operation.
- M. Setting of Car Door Contacts: The position of the car door at which the elevator may be started shall be measured. The distance from full closure shall not exceed that required by ASME A17.1. The test shall be

made with the hoistway doors closed or the hoistway door contact inoperative.

- N. Setting of Interlocks: The position of the hoistway door at which the elevator may be started shall be measured and shall not exceed ASME A17.1 requirements.
- O. Operating and Signal System: The elevator shall be operated by the operating devices provided and the operation signals and automatic floor leveling shall function in accordance with requirements specified. Starting, stopping and leveling shall be smooth and comfortable without appreciable steps of acceleration or deceleration.
- P. Performance of the Elevator supervisory system shall be witnessed and approved by the representative of the COTR.
- Q. Evidence of malfunction in any tested system or parts of equipment that occurs during the testing shall be corrected, repaired, or replaced at no additional cost to the Government, and the test repeated.
- R. If equipment fails test requirements and a re-inspection is required, the Contractor shall be responsible for the cost of re-inspection; salaries, transportation expenses, and per-diem expenses incurred by the representative of the COTR.

3.9 INSTRUCTION OF VA PERSONNEL

- A. Provide competent instruction to VA personnel regarding the operation of equipment and accessories installed under this contract, for a period equal to one eight hour work day. Instruction shall commence after completion of all work and at the time and place directed by the COTR.
- B. Written instructions in triplicate relative to care, adjustments and operation of all equipment and accessories shall be furnished and delivered to the COTR in independently bound folders. DVD recordings will also be acceptable. Written instructions shall include correct and legible wiring diagrams, nomenclature sheet of all electrical apparatus including location of each device, complete and comprehensive sequence of operation, complete replacement parts list with descriptive literature, and identification and diagrammatic cuts of equipment and parts. Information shall also include electrical operation characteristics of all circuits, relays, timers, and electronic devices, as well as R.P.M. values and related characteristics for all rotating equipment.

- C. Provide supplementary instruction for any new equipment that may become necessary because of changes, modifications or replacement of equipment or operation under requirements of paragraph entitled "Warranty of Construction".

3.10 INSPECTIONS AND SERVICE: GUARANTEE PERIOD OF SERVICE

- A. Furnish complete inspection and maintenance service on entire elevator installation for a period of one (1) year after completion and acceptance of all the elevators in this specification by the COTR. This maintenance service shall run concurrently with the warranty. Maintenance work shall be performed by Certified Elevator Mechanic and Apprentices employed and supervised by the company that is providing guaranteed period of service on the elevator equipment specified herein.
- B. This contract will cover full maintenance including emergency call back service, inspections and servicing the elevators listed in the schedule of elevator. The Elevator Contractor shall be required to perform the following:
 - 1. Bi-weekly systematic examination of equipment.
 - 2. During each maintenance visit the Elevator Contractor shall clean, lubricate, adjust, repair and replace all parts as necessary to keep the equipment in first class condition and proper working order.
 - 3. Furnishing all lubricant, cleaning materials, parts and tools necessary to perform the work required. Lubricants shall be only those products recommended by the manufacturer of the equipment.
 - 4. As required, motors, controllers, selectors, leveling devices, operating devices, switches on cars and in hoistways, hoistway doors and car doors or gate operating device, interlock contacts, guide shoes, guide rails, car door sills, hangers for doors, car doors or gates, and signal system shall be cleaned, lubricated and adjusted.
 - 5. Guide rails and bottom of platforms shall be cleaned every three months. Car tops and machine room floors shall be cleaned monthly. Accumulated rubbish shall be removed from the pits monthly. A general cleaning of the entire installation including all machine room equipment and hoistway equipment shall be accomplished quarterly. Cleaning supplies and vacuum cleaner shall be furnished by the Contractor.
 - 6. Maintain the performance standards set forth in this specification.

7. The operational system shall be maintained to the standards specified hereinafter including any changes or adjustments required to meet varying conditions of hospital occupancy.
 8. Maintain smooth starting and stopping and accurate leveling at all times.
- C. Maintenance service shall not include the performance of work required as a result of improper use, accidents, and negligence for which the Elevator Contractor is not directly responsible.
 - D. Provide 24 hour emergency call-back service that shall consist of promptly responding to calls within two hours for emergency service should a shutdown or emergency develop between regular examinations. Overtime emergency call-back service shall be limited to minor adjustments and repairs required to protect the immediate safety of the equipment and persons in and about the elevator.
 - E. Service and emergency personnel shall report to the COTR or his authorized representative upon arrival at the hospital and again upon completion of the required work. A copy of the work ticket containing a complete description of the work performed shall be given to the COTR.
 - F. The Elevator Contractor shall maintain a log book in the machine room. The log shall list the date and time of all bi-weekly examinations and all trouble calls. Each trouble call shall be fully described including the nature of the call, necessary correction performed or parts replaced.
 - G. Written "Maintenance Control Program" shall be in place to maintain the equipment in compliance with ASME A17.1 Section 8.6.

- - - E N D - - -

**SECTION 21 05 11
COMMON WORK RESULTS FOR FIRE SUPPRESSION**

PART 1 - GENERAL

1.1 DESCRIPTION

A. The requirements of this Section apply to all sections of Division 21.

B. Definitions:

1. Exposed: Piping and equipment exposed to view in finished rooms.

2. Option or optional: Contractor's choice of an alternate material or method.

1.2 RELATED WORK

A. Section 01 00 00, GENERAL REQUIREMENTS.

B. Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

C. Section 02 82 11, TRADITIONAL ASBESTOS ABATEMENT

D. Excavation and Backfill: Section 31 20 00, EARTH MOVING.

E. Building Components for Attachment of Hangers: Section 05 31 00, STEEL DECKING

F. Section 05 50 00, METAL FABRICATIONS.

G. Section 07 84 00, FIRESTOPPING.

H. Flashi

ng for Wall and Roof Penetrations: Section 07 60 00, FLASHING AND SHEET METAL.

I. Section 07 92 00, JOINT SEALANTS.

J. Section 09 51 00, ACOUSTICAL CEILINGS.

K. Section 09 91 00, PAINTING.

L. Section 13 05 41, SEISMIC RESTRAINT REQUIREMENTS FOR NON-STRUCTURAL COMPONENTS

M. Section 09 51 00, ACOUSTICAL CEILINGS

1.3 QUALITY ASSURANCE

A. Products Criteria:

1. Standard Products: Material and equipment shall be the standard products of a manufacturer regularly engaged in the manufacture of the products for at least 3 years. See other specification sections for any exceptions.

2. Equipment Service: Products shall be supported by a service organization which maintains a complete inventory of repair parts and is located reasonably close to the site.

3. Multiple Units: When two or more units of materials or equipment of the same type or class are required, these units shall be products of one manufacturer.

4. Assembled Units: Manufacturers of equipment assemblies, which use components made by others, assume complete responsibility for the final assembled product.
 5. Nameplates: Nameplate bearing manufacturer's name or identifiable trademark shall be securely affixed in a conspicuous place on equipment, or name or trademark cast integrally with equipment, stamped or otherwise permanently marked on each item of equipment.
 6. Asbestos products or equipment or materials containing asbestos shall not be used.
- B. Manufacturer's Recommendations: Where installation procedures or any part thereof are required to be in accordance with the recommendations of the manufacturer of the material being installed, printed copies of these recommendations shall be furnished to the Resident Engineer prior to installation. Installation of the item will not be allowed to proceed until the recommendations are received. Failure to furnish these recommendations can be cause for rejection of the material.
- C. Guaranty: In GENERAL CONDITIONS.
- D. Extended Guarantee Period Services:
1. Qualifications: All service technicians assigned to perform work under this contract shall be qualified and factory trained by the Original Equipment Manufacturer (O.E.M.). Each technician shall have at least three years experience of working on comparable systems and shall be a full time employee of the contractor. The contractor shall furnish, for the Department of Veterans Affairs (VA) review and approval, resumes of all service technicians scheduled to service the equipment and systems. The resume shall include details of experience, training, and educational qualifications and performance evaluations.
 2. Replacement Parts: The contractor shall be equipped with all replacement parts of all equipment and systems to be serviced and the manufacturer's standard service and repair procedures. All replacement parts shall be brand new and of current design. The replacement parts shall be O.E.M. items. Obsolete or refurbished parts are unacceptable. "Approved Equal" parts must have prior approval of the Contracting Officer. Contractor shall furnish evidence of guaranteed supply of parts for the life of the system.
 3. Service Supplies: The services shall include, without any additional cost to the government, all replacement parts, special tools and equipment, and consumable materials, that is, lubrication oil, grease, and cleaning materials, as required. The requirement of UL listing, where applicable, shall not be voided by any replacement

parts, components, software, or modifications provided by the contractor.

4. **Scheduled and Emergency Call Service:** The service shall include a scheduled monthly visit to perform systematic examination of equipment and/or systems and a 7 day, 24 hours call back service for emergency service. The emergency service is defined as a situation created by a breakdown or malfunction of any equipment or system warranting urgent attention. A qualified service representative shall respond to the VA request for emergency service within two hours and assess the problem either by telephone or remote diagnostic capability. If the emergency situation cannot be rectified by the VA personnel, on site emergency service shall be provided by sending a qualified service representative within 24 hours. For the rural locations of the VA medical centers, situated over 200 miles from the contractor's established service depot, the maximum response time of 48 hours shall be acceptable. The emergency service shall be limited to adjustments and repairs specifically required to protect the safety of the equipment for which the emergency service was required to be performed.
5. **Licensing:** The contractor shall be licensed to perform the contracted services. The contractor shall furnish details of all applicable local and state licensing requirements to VA as a part of the qualification requirements. The licenses shall be current, valid through the term of the contract and in the name of the contractor.
6. **Documentation Requirements:** The contractor shall maintain a separate log for each item of equipment and each system covered under the extended guarantee period service contract with the VA Medical Center (VAMC) Engineering Service. The log shall list dates and times of all scheduled and emergency calls. Each emergency call shall be described with details of the nature and causes of emergency, steps taken to rectify the situations, and specific recommendations to avoid such conditions in the future.
7. **Reports:** The contractor shall provide a quarterly report for the first year and twice a year for the remainder of the guarantee period for all equipment and systems serviced under the extended guarantee period contract. The report shall clearly and concisely describe the services rendered, parts replaced, and repairs performed. The report shall prescribe anticipated future needs of the equipment and systems for preventive and predictive maintenance.
8. **Quality Program:** The contractor shall provide a description of the quality management and control program. The description shall include

a tangible proof the existence of such program, names of at least three customers who have participated in the program, and specific information showing the applicability of program to the project.

9. Training: During each scheduled service visit, the contractor shall actively involve the VAMC maintenance personnel in performing scheduled service and associated activities. The practical training during the scheduled service visits shall include parting oral and written instructions, for each specific task of the servicing contract, to the VAMC maintenance personnel who shall operate the hardware and software in accordance with the intent of the design and under direct supervision of the service contractor's qualified service technician. At the end of the first year of the service contract, the contractor shall obtain a certificate from the VAMC Engineering Service confirming completion of training to the authorized VA representatives.

10. Classroom Training: Provide list and costs of available classroom training courses offered by contractor or O.E.M. //

E. Supports for sprinkler piping shall be in conformance with NFPA

13. 1.4 SUBMITTALS

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Manufacturer's Literature and Data: Submit under the pertinent section rather than under this section.
1. Equipment and materials identification.
 2. Fire-stopping materials.
 3. Hangers, inserts, supports and bracing. Provide load calculations for variable spring and constant support hangers.
 4. Wall, floor, and ceiling plates.
- C. Coordination Drawings: Provide detailed layout drawings of all piping systems.
- D. Maintenance Data and Operating Instructions:
1. Maintenance and operating manuals in accordance with Section 01 00 00, GENERAL REQUIREMENTS, Article, INSTRUCTIONS, for systems and equipment.
 2. Provide a listing of recommended replacement parts for keeping in stock supply, including sources of supply, for equipment. Include in the listing belts for equipment.

1.5 APPLICABLE PUBLICATIONS

- A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.

- B. American Society for Testing and Materials (ASTM):
- A36/A36M-2001Carbon Structural Steel
 - A575-96 Steel Bars, Carbon, Merchant Quality, M-Grades R
(2002)
 - E84-2003 Standard Test Method for Burning Characteristics
of Building Materials
 - E119-2000 Standard Test Method for Fire Tests of Building
Construction and Materials
- C. National Fire Protection Association (NFPA):
- 90A-96 Installation of Air Conditioning and Ventilating
Systems
 - 13-2010 Installation of fire sprinkler Systems
 - 101-97Life Safety Code

PART 2 - PRODUCTS

2.1 LIFTING ATTACHMENTS

Provide equipment with suitable lifting attachments to enable equipment to be lifted in its normal position. Lifting attachments shall withstand any handling conditions that might be encountered, without bending or distortion of shape, such as rapid lowering and braking of load.

2.2 EQUIPMENT AND MATERIALS IDENTIFICATION

- A. Use symbols, nomenclature and equipment numbers specified, shown on the drawings and shown in the maintenance manuals. Refer to Section 095100 for access identification markers and Section 099100 for identity markings and painting of systems to be accomplished by Mechanical Contractors.
- B. Interior (Indoor) Equipment: Engraved nameplates, with letters not less than 48 mm (3/16-inch) high of brass with black-filled letters, or rigid black plastic with white letters specified in Section 09 91 00, PAINTING permanently fastened to the equipment. Identify unit components such as coils, filters, fans, etc.
- C. Exterior (Outdoor) Equipment: Brass nameplates, with engraved black filled letters, not less than 48 mm (3/16-inch) high riveted or bolted to the equipment.
- D. Control Items: Label all temperature and humidity sensors, controllers and control dampers. Identify and label each item as they appear on the control diagrams.
- E. Valve Tags and Lists:
1. Valve tags: Engraved black filled numbers and letters not less than 13 mm (1/2-inch) high for number designation, and not less than 6.4 mm (1/4-inch) for service designation on 19 gage 38 mm (1-1/2 inches) round brass disc, attached with brass "S" hook or brass chain.

2. Valve lists: Typed or printed plastic coated card(s), sized 216 mm (8-1/2 inches) by 280 mm (11 inches) showing tag number, valve function and area of control, for each service or system. Punch sheets for a 3-ring notebook.
3. Provide detailed plan for each floor of the building indicating the location and valve number for each valve. Identify location of each valve with a color coded thumb tack in ceiling.

2.5 FIRESTOPPING

Section 07 84 00, FIRESTOPPING specifies an effective barrier against the spread of fire, smoke and gases where penetrations occur for piping.

2.6 GALVANIZED REPAIR COMPOUND

Mil. Spec. DOD-P-21035B, paint form.

2.7 PIPE PENETRATIONS

- A. Install sleeves during construction for other than blocked out floor openings for risers in mechanical bays.
- B. To prevent accidental liquid spills from passing to a lower level, provide the following:
 1. For sleeves: Extend sleeve 25 mm (one inch) above finished floor and provide sealant for watertight joint.
 2. For blocked out floor openings: Provide 40 mm (1-1/2 inch) angle set in silicone adhesive around opening.
 3. For drilled penetrations: Provide 40 mm (1-1/2 inch) angle ring or square set in silicone adhesive around penetration.
- C. Penetrations are not allowed through beams or ribs, but may be installed in concrete beam flanges. Any deviation from this requirement must receive prior approval of Resident Engineer.
- D. Sheet Metal, Plastic, or Moisture-resistant Fiber Sleeves: Provide for pipe passing through floors, interior walls, and partitions, unless brass or steel pipe sleeves are specifically called for below.
- E. Cast Iron or Zinc Coated Pipe Sleeves: Provide for pipe passing through exterior walls below grade. Make space between sleeve and pipe watertight with a modular or link rubber seal. Seal shall be applied at both ends of sleeve.
- F. Galvanized Steel or an alternate Black Iron Pipe with asphalt coating Sleeves: Provide for pipe passing through concrete beam flanges, except where brass pipe sleeves are called for. Provide sleeve for pipe passing through floor of mechanical rooms, laundry work rooms, and animal rooms above basement. Except in mechanical rooms, connect sleeve with floor plate.
- G. Brass Pipe Sleeves: Provide for pipe passing through quarry tile, terrazzo or ceramic tile floors. Connect sleeve with floor plate.

- H. Sleeves are not required for wall hydrants for fire department connections or in drywall construction.
- I. Sleeve Clearance: Sleeve through floors, walls, partitions, and beam flanges shall be one inch greater in diameter than external diameter of pipe. Sleeve for pipe with insulation shall be large enough to accommodate the insulation. Interior openings shall be caulked tight with fire stopping material and sealant to prevent the spread of fire, smoke, and gases.
- J. Sealant and Adhesives: Shall be as specified in Section 07 92 00, JOINT SEALANTS.

2.8 TOOLS AND LUBRICANTS

- A. Furnish, and turn over to the Resident Engineer, special tools not readily available commercially, that are required for disassembly or adjustment of equipment and machinery furnished.
- B. Grease Guns with Attachments for Applicable Fittings: One for each type of grease required for each motor or other equipment.
- C. Tool Containers: Hardwood or metal, permanently identified for intended service and mounted, or located, where directed by the Resident Engineer.
- D. Lubricants: A minimum of 0.95 L (one quart) of oil, and 0.45 kg (one pound) of grease, of equipment manufacturer's recommended grade and type, in unopened containers and properly identified as to use for each different application.

2.9 WALL, FLOOR AND CEILING PLATES

- A. Material and Type: Chrome plated brass or chrome plated steel, one piece or split type with concealed hinge, with set screw for fastening to pipe, or sleeve. Use plates that fit tight around pipes, cover openings around pipes and cover the entire pipe sleeve projection.
- B. Thickness: Not less than 2.4 mm (3/32-inch) for floor plates. For wall and ceiling plates, not less than 0.64 mm (0.025-inch) for up to 80 mm (3-inch pipe), 0.89 mm (0.035-inch) for larger pipe.
- C. Locations: Use where pipe penetrates floors, walls and ceilings in exposed locations, in finished areas only. Use also where insulation ends on exposed water supply pipe drop from overhead. Provide a watertight joint in spaces where brass or steel pipe sleeves are specified.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Coordinate location of piping, sleeves, inserts, hangers, and equipment. Locate piping, sleeves, inserts, hangers, and equipment clear of

11-09

windows, doors, openings, 21 05 11 - 8 light outlets, and other

services and utilities. Follow manufacturer's published recommendations for installation methods not otherwise specified.

B. Protection and Cleaning:

1. Equipment and materials shall be carefully handled, properly stored, and adequately protected to prevent damage before and during installation, in accordance with the manufacturer's recommendations and as approved by the Resident Engineer. Damaged or defective items in the opinion of the Resident Engineer, shall be replaced.
2. Protect all finished parts of equipment, such as shafts and bearings where accessible, from rust prior to operation by means of protective grease coating and wrapping. Close pipe openings with caps or plugs during installation. Tightly cover and protect equipment against dirt, water chemical, or mechanical injury. At completion of all work thoroughly exposed materials and equipment.

C. Concrete and Grout: Use concrete and shrink compensating grout 25 MPa (3000 psi) minimum, specified in Section 03 30 00, CAST-IN-PLACE CONCRETE.

D. Install gages, valves, and other devices with due regard for ease in reading or operating and maintaining said devices. Locate and position gages to be easily read by operator or staff standing on floor or walkway provided. Servicing shall not require dismantling adjacent equipment or pipe work.

E. Switchgear Drip Protection: Every effort shall be made to eliminate the installation of pipe above electrical and telephone switchgear. If this is not possible, encase pipe in a second pipe with a minimum of joints.

F. Inaccessible Equipment:

1. Where the Government determines that the Contractor has installed equipment not conveniently accessible for operation and maintenance, equipment shall be removed and reinstalled or remedial action performed as directed at no additional cost to the Government.
2. The term "conveniently accessible" is defined as capable of being reached without the use of ladders, or without climbing or crawling under or over obstacles such as motors, fans, pumps, belt guards, transformers, high voltage lines, piping, and ductwork.

3.3 LUBRICATION

Field check and lubricate equipment requiring lubrication prior to initial operation.

3.4 STARTUP AND TEMPORARY OPERATION

Start up equipment as described in equipment specifications. Verify that vibration is within specified tolerance prior to extended operation.

Temporary use of equipment is specified in Section 01 00 00, GENERAL REQUIREMENTS, Article, TEMPORARY USE OF MECHANICAL AND ELECTRICAL EQUIPMENT.

3.5 OPERATING AND PERFORMANCE TESTS

- A. Prior to the final inspection, perform required tests as specified in Section 01 00 00, GENERAL REQUIREMENTS, Article, TESTS and submit the test reports and records to the Resident Engineer.
- B. Should evidence of malfunction in any tested system, or piece of equipment or component part thereof, occur during or as a result of tests, make proper corrections, repairs or replacements, and repeat tests at no additional cost to the Government.
- C. When completion of certain work or system occurs at a time when final control settings and adjustments cannot be properly made to make performance tests, then make performance tests for heating systems and for cooling systems respectively during first actual seasonal use of respective systems following completion of work.

3.6 INSTRUCTIONS TO VA PERSONNEL

Provide in accordance with Article, INSTRUCTIONS, of Section 01 00 00, GENERAL REQUIREMENTS.

- - - E N D - - -

THIS PAGE INTENTIONALLY LEFT BLANK

SECTION 21 13 13
WET-PIPE SPRINKLER SYSTEMS

PART 1 - GENERAL

1.1 SCOPE OF WORK

- A. Design, installation and testing shall be in accordance with NFPA 13 except for specified exceptions.
- B. The design and installation of a hydraulically calculated automatic wet system complete and ready for operation, for all portions of new Extended Care Unit Building B121 B122 CLC.

1.2 RELATED WORK

- A. Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Section 33 10 00, WATER UTILITIES.
- C. Section 07 84 00, FIRESTOPPING, Treatment of penetrations through rated enclosures.
- D. Section 09 91 00, PAINTING.
- E. Section 28 31 00, FIRE DETECTION AND ALARM, Connection to fire alarm of flow switches, pressure switches and valve supervisory switches.
- F. Section 21 05 11 COMMON WORK RESULTS FOR FIRE

SUPPRESSION 1.3 QUALITY ASSURANCE

- A. Installer Reliability: The installer shall possess a valid State of Idaho fire sprinkler contractor's license. The installer shall have been actively and successfully engaged in the installation of commercial automatic sprinkler systems for the past ten years.
- B. Materials and Equipment: All equipment and devices shall be of a make and type listed by UL and approved by FM, or other nationally recognized testing laboratory for the specific purpose for which it is used. All materials, devices, and equipment shall be approved by the VA.
- C. Submittals: Submit as one package in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES. Prepare detailed working drawings that are signed by a NICET Level III or Level IV Sprinkler Technician or stamped by a Registered Professional Engineer practicing in the field of Fire Protection Engineering. As Government review is for technical adequacy only, the installer remains responsible for correcting any conflicts with other trades and building construction that arise during installation. Partial submittals will not be accepted. Material submittals shall be approved prior to the purchase or delivery to the job site. Suitably bind submittals in notebooks or

binders and provide index referencing the appropriate specification section. Submittals shall include, but not be limited to, the following:

1. Qualifications:
 - a. Provide a copy of the installing contractors fire sprinkler contractor's license.
 - b. Provide a copy of the NICET certification for the NICET Level III or Level IV Sprinkler Technician who prepared and signed the detailed working drawings unless the drawings are stamped by a Registered Professional Engineer practicing in the field of Fire Protection Engineering.
2. Drawings: Submit detailed 1:100 (1/8 inch) scale (minimum) working drawings conforming to NFPA 13. Include a site plan showing the piping to the water supply test location.
3. Manufacturers Data Sheets:
 - a. For backflow preventers, provide flow test curves from UL, FM, or the Foundation for Hydraulic Research and Cross-Connection Control to verify pressure loss calculations.
 - b. Provide for materials and equipment proposed for use on the system. Include listing information and installation instructions in data sheets. Where data sheet describes items in addition to that item being submitted, clearly identify proposed item on the sheet.
4. Calculation Sheets: Submit hydraulic calculation sheets in tabular form conforming to the requirements and recommendations of NFPA 13.
5. Final Document Submittals: Provide as-built drawings, testing and maintenance instructions in accordance with the requirements in Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

Submittals shall include, but not be limited to, the following:

 - a. One complete set of reproducible as-built drawings showing the installed system with the specific interconnections between the waterflow switch or pressure switch and the fire alarm equipment.
 - b. Complete, simple, understandable, step-by-step, testing instructions giving recommended and required testing frequency of all equipment, methods for testing all equipment, and a complete trouble shooting manual. Provide maintenance instructions on replacing any components of the system including internal parts, periodic cleaning and adjustment of the equipment and components with information as to the address and telephone number of both the manufacturer and the local supplier of each item.

- c. Material and Testing Certificate: Upon completion of the sprinkler system installation or any partial section of the system, including testing and flushing, provide a copy of a completed Material and Testing Certificate as indicated in NFPA 13.
 - d. Certificates shall document all parts of the installation.
 - e. Instruction Manual: Provide one copy of the instruction manual covering the system in a flexible protective cover and mount in an accessible location adjacent to the riser.
- D. Design Basis Information: Provide design, materials, equipment, installation, inspection, and testing of the automatic sprinkler system in accordance with the requirements of NFPA 13. Recommendations in appendices shall be treated as requirements.
1. Perform hydraulic calculations in accordance with NFPA 13 utilizing the Area/Density method. Do not restrict design area reductions permitted for using quick response sprinklers throughout by the required use of standard response sprinklers in the areas identified in this section.
 2. Sprinkler Protection: To determining spacing and sizing, apply the following coverage classifications:
 - a. Light Hazard Occupancies: Patient care, bedrooms, bathrooms, corridors, vestibules, lobbies, living room, den and similar areas
 - b. Ordinary Hazard Group 1 Occupancies: Mechanical Equipment Rooms, Transformer Rooms, Electrical Switchgear Rooms, Electric Closets, Elevator Shafts, Elevator Machine Rooms,,
 - c. Ordinary Hazard Group 2 Occupancies: Storage rooms, trash rooms, clean and soiled linen rooms, pharmacy and associated storage, laundry, kitchens, kitchen storage areas.
 - d. Request clarification from the Government for any hazard classification not identified.
 3. Hydraulic Calculations: Calculated demand including hose stream requirements shall fall no less than 10 percent below the available water supply curve.
 4. Water Supply: The Fire Protection subcontractor shall perform a fire hydrant flow test in accordance with NFPA 291 after award of the contract but before beginning design of the fire sprinkler system. Apply appropriate reduction factors to account for seasonal variations. Schedule all flow tests with VA personnel. Submit a copy of the flow test report to the project engineer.
 5. Hydraulic calculations for the fire sprinkler system shall extend to the point of connection to the nearest circulating water supply main.

The following pressures and flow may be used for planning/estimated purposes:

Static Pressure: 65 psi

Residual Pressure: 30 psi

Flow: 1071 gpm

6. Zoning:

- a. For each sprinkler zone provide a control valve, flow switch and a test and drain assembly with pressure gauge.
- b. Provide seismic protection in accordance with NFPA

13. 1.4 APPLICABLE PUBLICATIONS

A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.

B. National Fire Protection Association (NFPA):

13-2010 Installation of Sprinkler Systems

101-2010 Safety to Life from Fire in Buildings and Structures (Life Safety Code)

170-1999 Fire Safety Symbols

SPEC WRITER NOTE: Specify the latest

C. Underwriters Laboratories, Inc. (UL): Fire Protection Equipment Directory - 2001

D. Factory Mutual Engineering Corporation (FM): Approval Guide - 2001

E. International Building Code - 2009

F. Foundation for Cross-Connection Control and Hydraulic Research-2005

PART 2 PRODUCTS

2.1 PIPING & FITTINGS

A. Sprinkler systems in accordance with NFPA 13. Use nonferrous piping in MRI Scanning Rooms.

2.2 VALVES

A. Valves in accordance with NFPA 13.

B. Do not use quarter turn ball valves for 50 mm (2 inch) or larger drain valves.

C. The wet system control valve shall be a listed indicating type valve. Control valve shall be UL Listed and FM Approved for fire protection installations. System control valve shall be rated for normal system pressure but in no case less than 175 PSI. (No Substitutions Allowed).

- D. Double Check Valve Assembly, listed for vertical installation, UL Listed and meeting International Plumbing Code requirements. Ames "Colt" Series 200, Wilkins 350 ADA or Watts 774 DCDA
- E. Automatic Ball Drips: Cast brass 20 mm (3/4 inch) in-line automatic ball drip with both ends threaded with iron pipe threads.

2.3 FIRE DEPARTMENT SIAMESE CONNECTION

- A. Chrome plated, flush wall type, exterior fire department connection with chrome escutcheon plate, without sill cock, and a minimum of two 65 mm (2-1/2 inch) connections threaded to match those on the local fire protection service, with chrome plated caps and chains. Provide escutcheon with integral raised letters "Automatic Sprinkler" Install an automatic ball drip between fire department connection and check valve with drain piping routed to the exterior of the building or a floor drain.

2.4 SPRINKLERS

- A. All sprinklers except "residential type sprinklers shall be FM approved. Provide quick response sprinklers in all areas, except where specifically prohibited by their listing or approval.
 - 1. Elevator shafts and elevator machine rooms: Standard response sprinklers.
 - 2. Elevator pit: sidewall sprinklers.
 - 3. In bedrooms and adjacent bathrooms: residential type, pendent fire sprinklers with recessed escutcheons.
- B. Temperature Ratings: In accordance with NFPA 13, except as follows:
 - 1. Sprinklers in elevator shafts, elevator pits, and elevator machine rooms: Intermediate temperature rated.

2.5 SPRINKLER CABINET

Provide sprinkler cabinet with the required number of sprinkler heads of all ratings and types installed, and a sprinkler wrench for each system. Locate adjacent to the riser. Sprinkler heads shall be installed in center of tile or center to center.

2.6 IDENTIFICATION SIGNS/HYDRAULIC PLACARDS

Plastic, steel or aluminum signs with white lettering on a red background with holes for easy attachment. Enter pertinent data for each system on the hydraulic placard.

2.7 SWITCHES:

- A. Contain in a weatherproof die cast/red baked enamel, oil resistant, aluminum housing with tamper resistant screws, 13 mm (1/2 inch) conduit

entrance and necessary facilities for attachment to the valves.

Provide two SPDT switches rated at 2.5 amps at 24 VDC.

- B. Water flow Alarm Switches: Mechanical, non-coded, non-accumulative retard and adjustable from 0 to 60 seconds minimum. Set flow switches at an initial setting between 20 and 30 seconds.
- C. Valve Supervisory Switches for Ball and Butterfly Valves: May be integral with the valve.

2.8 WATER FLOW BELL

Provide and install a 10" electric bell on the exterior of the building. Locate the water flow bell on the portion of the wall nearest to the FDC. Location of water flow bell shall be approved by the project architect. Power to bell and wiring to fire alarm systems shall be the responsibility of the fire alarm contractor

2.9 GAUGES

Provide gauges as required by NFPA 13.

2.10 PIPE HANGERS AND SUPPORTS

Supports, hangers, etc., of an approved pattern placement to conform to NFPA 13. System piping shall be substantially supported to the building structure. The installation of hangers and supports shall adhere to the requirements set forth in NFPA 13, Standard for Installation of Sprinkler Systems. Materials used in the installation or construction of hangers and supports shall be listed and approved for such application. Hangers or supports not specifically listed for service shall be designed and bear the seal of a professional engineer.

2.11 WALL, FLOOR AND CEILING PLATES

Provide chrome plated steel escutcheon plates for exposed piping passing through walls, floors or ceilings.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Installation shall be accomplished by the licensed contractor. Provide a qualified technician, experienced in the installation and operation of the type of system being installed, to supervise the installation and testing of the system.
- B. Installation of Piping: Accurately cut pipe to measurements established by the installer and work into place without springing or forcing. In any situation where bending of the pipe is required, use a standard pipe-bending template. Install concealed piping in spaces that have finished ceilings. Where ceiling mounted equipment exists, such as in

- operating and radiology rooms, install sprinklers so as not to obstruct the movement or operation of the equipment. Sidewall heads may need to be utilized. Locate piping in stairways as near to the ceiling as possible to prevent tampering by unauthorized personnel, and to provide a minimum headroom clearance of 2250 mm (seven feet six inches). To prevent an obstruction to egress, provide piping clearances in accordance with NFPA 101.
- C. Welding: Conform to the requirements and recommendations of NFPA 13.
 - D. Drains: Pipe drains to discharge at safe points outside of the building or to sight cones attached to drains of adequate size to readily carry the full flow from each drain under maximum pressure. Do not provide a direct drain connection to sewer system or discharge into sinks. Install drips and drains where necessary and required by NFPA 13.
 - E. Supervisory Switches: Provide supervisory switches for sprinkler control valves.
 - F. Waterflow Alarm Switches: Install waterflow switch and adjacent valves in easily accessible locations.
 - G. Inspector's Test Connection: Install and supply in conformance with NFPA 13, locate in a secured area, and discharge to the exterior of the building.
 - H. Affix cutout disks, which are created by cutting holes in the walls of pipe for flow switches and non-threaded pipe connections to the respective waterflow switch or pipe connection near to the pipe from where they were cut.
 - I. Sleeves: Provide for pipes passing through masonry or concrete. Provide space between the pipe and the sleeve in accordance with NFPA 13. Seal this space with a UL Listed through penetration fire stop material in accordance with Section 07 84 00, FIRESTOPPING. Where core drilling is used in lieu of sleeves, also seal space. Seal penetrations of walls, floors and ceilings of other types of construction, in accordance with Section 07 84 00, FIRESTOPPING.
 - J. Provide pressure gauge at each water flow alarm switch location and at each main drain connection.
 - K. For each fire department connection, provide the symbolic sign given in NFPA 170 and locate 2400 to 3000 mm (8 to 10 feet) above each connection location. Size the sign to 450 by 450 mm (18 by 18 inches) with the symbol being at least 350 by 350 mm (14 by 14 inches).
 - L. Firestopping shall comply with Section 07 84 00, FIRESTOPPING.

- M. Securely attach identification signs to control valves, drain valves, and test valves. Locate hydraulic placard information signs at each sectional control valve where there is a zone water flow switch.
- N. Repairs: Repair damage to the building or equipment resulting from the installation of the sprinkler system by the installer at no additional expense to the Government.

3.2 INSPECTION AND TEST

- A. Preliminary Testing: Flush newly installed systems prior to performing hydrostatic tests in order to remove any debris which may have been left as well as ensuring piping is unobstructed. Hydrostatically test system, including the fire department connections, as specified in NFPA 13, in the presence of the Contracting Officers Technical Representative (COTR) or his designated representative. Test and flush underground water line prior to performing these hydrostatic tests.
- B. Final Inspection and Testing: Subject system to tests in accordance with NFPA 13, and when all necessary corrections have been accomplished, advise COTR/Resident Engineer to schedule a final inspection and test. Connection to the fire alarm system shall have been in service for at least ten days prior to the final inspection, with adjustments made to prevent false alarms. Furnish all instruments, labor and materials required for the tests and provide the services of the installation foreman or other competent representative of the installer to perform the tests. Correct deficiencies and retest system as necessary, prior to the final acceptance. Include the operation of all features of the systems under normal operations in test.

3.3 INSTRUCTIONS

Furnish the services of a competent instructor for not less than two hours for instructing personnel in the operation and maintenance of the system, on the dates requested by the COTR/Resident Engineer.

- - - E N D - - -

SECTION 22 05 11
COMMON WORK RESULTS FOR PLUMBING

PART 1 - GENERAL

1.1 DESCRIPTION

- A. The requirements of this Section shall apply to all sections of Division 22.
- B. Definitions:
 - 1. Exposed: Piping and equipment exposed to view in finished rooms.
 - 2. Option or optional: Contractor's choice of an alternate material or method.

1.2 RELATED WORK

- A. Section 01 00 00, GENERAL REQUIREMENTS.
- B. Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- C. Section 02 82 13.41, TRADITIONAL ASBESTOS ABATEMENT
- D. Section 31 20 00, EARTH MOVING: Excavation and Backfill.
- E. Section 03 30 00, CAST-IN-PLACE CONCRETE: Concrete and Grout.
- F. Section 05 31 00, STEEL DECKING, Section 05 36 00, COMPOSITE METAL DECKING. Building Components for Attachment of Hangers.
- G. Section 05 50 00, METAL FABRICATIONS.
- H. Section 07 84 00, FIRESTOPPING.
- I. Section 07 60 00, FLASHING AND SHEET METAL: Flashing for Wall and Roof Penetrations.
- J. Section 07 92 00, JOINT SEALANTS.
- K. Section 09 51 00, ACOUSTICAL CEILINGS.
- L. Section 09 91 00, PAINTING.
- M. Section 13 05 41, SEISMIC RESTRAINT REQUIREMENTS FOR NON-STRUCTURAL COMPONENTS
- N. Section 23 07 11, HVAC, PLUMBING, AND BOILER PLANT INSULATION.
- O. Section 23 09 23, DIRECT DIGITAL CONTROLS FOR HVAC.
- P. Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS
- Q. Section 22 05 12, GENERAL MOTOR REQUIREMENTS FOR PLUMBING EQUIPMENT .
- R. Section 26 29 11, LOW-VOLTAGE MOTOR STARTERS.

1.3 QUALITY ASSURANCE

- A. Products Criteria:
 - 1. Standard Products: Material and equipment shall be the standard products of a manufacturer regularly engaged in the manufacture of the products for at least 3 years. However, digital electronics devices, software and systems such as controls, instruments,

computer work station, shall be the current generation of technology and basic design that has a proven satisfactory service record of at least three years.

2. Equipment Service: There shall be permanent service organizations, authorized and trained by manufacturers of the equipment supplied, located within 160 km (100 miles) of the project. These organizations shall come to the site and provide acceptable service to restore operations within four hours of receipt of notification by phone, e-mail or fax in event of an emergency, such as the shut-down of equipment; or within 24 hours in a non-emergency. Names, mail and e-mail addresses and phone numbers of service organizations providing service under these conditions for (as applicable to the project): pumps, critical instrumentation, computer workstation and programming shall be submitted for project record and inserted into the operations and maintenance manual.
3. All items furnished shall be free from defects that would adversely affect the performance, maintainability and appearance of individual components and overall assembly.
4. The products and execution of work specified in Division 22 shall conform to the referenced codes and standards as required by the specifications. Local codes and amendments enforced by the local code official shall be enforced, if required by local authorities such as the natural gas supplier. If the local codes are more stringent, then the local code shall apply. Any conflicts shall be brought to the attention of the Resident Engineer (RE)/Contracting Officers Technical Representative (COTR).
5. Multiple Units: When two or more units of materials or equipment of the same type or class are required, these units shall be products of one manufacturer.
6. Assembled Units: Manufacturers of equipment assemblies, which use components made by others, assume complete responsibility for the final assembled product.
7. Nameplates: Nameplate bearing manufacturer's name or identifiable trademark shall be securely affixed in a conspicuous place on equipment, or name or trademark cast integrally with equipment, stamped or otherwise permanently marked on each item of equipment.
8. Asbestos products or equipment or materials containing asbestos shall not be used.

- B. Welding: Before any welding is performed, contractor shall submit a certificate certifying that welders comply with the following requirements:
1. Qualify welding processes and operators for piping according to ASME "Boiler and Pressure Vessel Code", Section IX, "Welding and Brazing Qualifications".
 2. Comply with provisions of ASME B31 series "Code for Pressure Piping".
 3. Certify that each welder has passed American Welding Society (AWS) qualification tests for the welding processes involved, and that certification is current.
 4. All welds shall be stamped according to the provisions of the American Welding Society.
- C. Manufacturer's Recommendations: Where installation procedures or any part thereof are required to be in accordance with the recommendations of the manufacturer of the material being installed, printed copies of these recommendations shall be furnished to the Resident Engineer prior to installation. Installation of the item will not be allowed to proceed until the recommendations are received. Failure to furnish these recommendations can be cause for rejection of the material.
- D. Execution (Installation, Construction) Quality:
1. All items shall be applied and installed in accordance with manufacturer's written instructions. Conflicts between the manufacturer's instructions and the contract drawings and specifications shall be referred to the RE/COTR for resolution. Written hard copies or computer files of manufacturer's installation instructions shall be provided to the RE/COTR at least two weeks prior to commencing installation of any item.
 2. Complete layout drawings shall be required by Paragraph, SUBMITTALS. Construction work shall not start on any system until the layout drawings have been approved.
- E. Guaranty: Warranty of Construction, FAR clause 52.246-21.
- F. Plumbing Systems: UPC-2009.

1.4 SUBMITTALS

- A. Submittals shall be submitted in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, and SAMPLES.

- B. Information and material submitted under this section shall be marked "SUBMITTED UNDER SECTION 22 05 11, COMMON WORK RESULTS FOR PLUMBING", with applicable paragraph identification.
- C. Contractor shall make all necessary field measurements and investigations to assure that the equipment and assemblies will meet contract requirements.
- D. If equipment is submitted which differs in arrangement from that shown, provide drawings that show the rearrangement of all associated systems. Approval will be given only if all features of the equipment and associated systems, including accessibility, are equivalent to that required by the contract.
- E. Prior to submitting shop drawings for approval, contractor shall certify in writing that manufacturers of all major items of equipment have each reviewed drawings and specifications, and have jointly coordinated and properly integrated their equipment and controls to provide a complete and efficient installation.
- F. Upon request by Government, lists of previous installations for selected items of equipment shall be provided. Contact persons who will serve as references, with telephone numbers and e-mail addresses shall be submitted with the references.
- G. Manufacturer's Literature and Data: Manufacturer's literature shall be submitted under the pertinent section rather than under this section.
1. Electric motor data and variable speed drive data shall be submitted with the driven equipment.
 2. Equipment and materials identification.
 3. Fire stopping materials.
 4. Hangers, inserts, supports and bracing. Provide load calculations for variable spring and constant support hangers.
 5. Wall, floor, and ceiling plates.
- H. Coordination Drawings: Complete consolidated and coordinated layout drawings shall be submitted for all new systems, and for existing systems that are in the same areas. The drawings shall include plan views, elevations and sections of all systems and shall be on a scale of not less than 1:32 (3/8-inch equal to one foot). Clearly identify and dimension the proposed locations of the principal items of equipment. The drawings shall clearly show the proposed location and adequate clearance for all equipment, piping, pumps, valves and other items. All valves, trap primer valves, water hammer arrestors,

strainers, and equipment requiring service shall be provided with an access door sized for the complete removal of plumbing device, component, or equipment. Equipment foundations shall not be installed until equipment or piping until layout drawings have been approved. Detailed layout drawings shall be provided for all piping systems. In addition, details of the following shall be provided.

1. Mechanical equipment rooms.
2. Interstitial space.
3. Hangers, inserts, supports, and bracing.
4. Pipe sleeves.
5. Equipment penetrations of floors, walls, ceilings, or

roofs. I. Maintenance Data and Operating Instructions:

1. Maintenance and operating manuals in accordance with Section 01 00 00, GENERAL REQUIREMENTS, Article, INSTRUCTIONS, for systems and equipment.
2. Listing of recommended replacement parts for keeping in stock supply, including sources of supply, for equipment shall be provided.
3. The listing shall include belts for equipment: Belt manufacturer, model number, size and style, and distinguished whether of multiple belt sets.

1.5 DELIVERY, STORAGE AND HANDLING

A. Protection of Equipment:

1. Equipment and material placed on the job site shall remain in the custody of the Contractor until phased acceptance, whether or not the Government has reimbursed the Contractor for the equipment and material. The Contractor is solely responsible for the protection of such equipment and material against any damage.
2. Damaged equipment shall be replaced with an identical unit as determined and directed by the RE/COTR. Such replacement shall be at no additional cost to the Government.
3. Interiors of new equipment and piping systems shall be protected against entry of foreign matter. Both inside and outside shall be cleaned before painting or placing equipment in operation.
4. Existing equipment and piping being worked on by the Contractor shall be under the custody and responsibility of the Contractor and shall be protected as required for new work.

B. Cleanliness of Piping and Equipment Systems:

1. Care shall be exercised in the storage and handling of equipment and piping material to be incorporated in the work. Debris arising from cutting, threading and welding of piping shall be removed.
2. Piping systems shall be flushed, blown or pigged as necessary to deliver clean systems.
3. The interior of all tanks shall be cleaned prior to delivery and beneficial use by the Government. All piping shall be tested in accordance with the specifications and the UPC, latest edition. All filters, strainers, fixture faucets shall be flushed of debris prior to final acceptance.
4. Contractor shall be fully responsible for all costs, damage, and delay arising from failure to provide clean systems.

1.6 APPLICABLE PUBLICATIONS

A. The publications listed below shall form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.

B. American Society of Mechanical Engineers

(ASME): Boiler and Pressure Vessel Code (BPVC):

SEC IX-2007 Boiler and Pressure Vessel Code; Section IX,
Welding and Brazing Qualifications.

C. American Society for Testing and Materials (ASTM):

A36/A36M-2008 Standard Specification for Carbon Structural
Steel

A575-96 (R 2007) Standard Specification for Steel Bars, Carbon,
Merchant Quality, M-Grades R (2002)

E84-2005 Standard Test Method for Surface Burning
Characteristics of Building Materials

E119-2008a Standard Test Methods for Fire Tests of
Building Construction and Materials

D. Manufacturers Standardization Society (MSS) of the Valve and Fittings Industry, Inc:

SP-58-02 Pipe Hangers and Supports-Materials, Design and
Manufacture

SP 69-2003 (R 2004) ... Pipe Hangers and Supports-Selection and
Application

E. National Electrical Manufacturers Association (NEMA):

MG1-2003, Rev. 1-2007 ..Motors and Generators

F. International Code Council, (ICC):

IBC-06, (R 2007) International Building Code

IPC-06, (R 2007) International Plumbing Code

PART 2 - PRODUCTS

2.1 FACTORY-ASSEMBLED PRODUCTS

- A. STANDARDIZATION OF COMPONENTS SHALL BE MAXIMIZED TO REDUCE SPARE PART requirements.
- B. Manufacturers of equipment assemblies that include components made by others shall assume complete responsibility for final assembled unit.
1. All components of an assembled unit need not be products of same manufacturer.
 2. Constituent parts that are alike shall be products of a single manufacturer.
 3. Components shall be compatible with each other and with the total assembly for intended service.
 4. Contractor shall guarantee performance of assemblies of components, and shall repair or replace elements of the assemblies as required to deliver specified performance of the complete assembly.
- C. Components of equipment shall bear manufacturer's name and trademark, model number, serial number and performance data on a name plate securely affixed in a conspicuous place, or cast integral with, stamped or otherwise permanently marked upon the components of the equipment.
- D. Major items of equipment, which serve the same function, shall be the same make and model

2.2 COMPATIBILITY OF RELATED EQUIPMENT

- A. Equipment and materials installed shall be compatible in all respects with other items being furnished and with existing items so that the result will be a complete and fully operational system that conforms to contract requirements.

2.3 SAFETY GUARDS

- A. Pump shafts and couplings shall be fully guarded by a sheet steel guard, covering coupling and shaft but not bearings. Material shall be minimum 16-gage sheet steel; ends shall be braked and drilled and attached to pump base with minimum of four 6 mm (1/4-inch) bolts. Reinforce guard as necessary to prevent side play forcing guard onto couplings.
- B. All Equipment shall have moving parts protected from personal injury.

2.4 LIFTING ATTACHMENTS

Equipment shall be provided with suitable lifting attachments to enable equipment to be lifted in its normal position. Lifting attachments shall withstand any handling conditions that might be encountered, without bending or distortion of shape, such as rapid lowering and braking of load.

2.5 ELECTRIC MOTORS, MOTOR CONTROL, CONTROL WIRING

- A. All material and equipment furnished and installation methods shall conform to the requirements of Section 22 05 12, GENERAL MOTOR REQUIREMENTS FOR PLUMBING EQUIPMENT; Section 26 29 11, LOW-VOLTAGE MOTOR STARTERS; and, Section 26 05 21, LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES (600 VOLTS AND BELOW). All electrical wiring, conduit, and devices necessary for the proper connection, protection and operation of the systems shall be provided. Premium efficient motors shall be provided. Unless otherwise specified for a particular application, electric motors shall have the following requirements.
- B. Special Requirements:
1. Where motor power requirements of equipment furnished deviate from power shown on plans, provide electrical service designed under the requirements of NFPA 70 without additional time or cost to the Government.
 2. Assemblies of motors, starters, and controls and interlocks on factory assembled and wired devices shall be in accordance with the requirements of this specification.
 3. Wire and cable materials specified in the electrical division of the specifications shall be modified as follows:
 - a. Wiring material located where temperatures can exceed 71° C (160° F) shall be stranded copper with Teflon FEP insulation with jacket. This includes wiring on the boilers.
 - b. Other wiring at boilers and to control panels shall be NFPA 70 designation THWN.
 - c. Shielded conductors or wiring in separate conduits for all instrumentation and control systems shall be provided where recommended by manufacturer of equipment.
 4. Motor sizes shall be selected so that the motors do not operate into the service factor at maximum required loads on the driven equipment. Motors on pumps shall be sized for non-overloading at all points on the pump performance curves.

5. Motors utilized with variable frequency drives shall be rated "inverter-ready" per NEMA Standard, MG1, Part 31.4.4.2.

- C. Motor Efficiency and Power Factor: All motors, when specified as "high efficiency or Premium Efficiency" by the project specifications on driven equipment, shall conform to efficiency and power factor requirements in Section 22 05 12, GENERAL MOTOR REQUIREMENTS FOR PLUMBING EQUIPMENT, with no consideration of annual service hours. Motor manufacturers generally define these efficiency requirements as "NEMA premium efficient" and the requirements generally exceed those of the Energy Policy Act of 1992 (EPACT). Motors not specified as "high efficiency or premium efficient" shall comply with EPACT.
- D. Single-phase Motors: Capacitor-start type for hard starting applications. Motors for centrifugal fans and pumps may be split phase or permanent split capacitor (PSC).
- E. Poly-phase Motors: NEMA Design B, Squirrel cage, induction type. Each two-speed motor shall have two separate windings. A time delay (20 seconds minimum) relay shall be provided for switching from high to low speed.
- F. Rating: Rating shall be continuous duty at 100 percent capacity in an ambient temperature of 40° C (104° F); minimum horsepower as shown on drawings; maximum horsepower in normal operation shall not exceed nameplate rating without service factor.
- G. Insulation Resistance: Not less than one-half meg-ohm between stator conductors and frame shall be measured at the time of final inspection.

2.7 EQUIPMENT AND MATERIALS IDENTIFICATION

- A. Use symbols, nomenclature and equipment numbers specified, shown on the drawings, or shown in the maintenance manuals. Identification for piping is specified in Section 09 91 00, PAINTING.
- B. Interior (Indoor) Equipment: Engraved nameplates, with letters not less than 48 mm (3/16-inch) high of brass with black-filled letters, or rigid black plastic with white letters specified in Section 09 91 00, PAINTING shall be permanently fastened to the equipment. Unit components such as water heaters, tanks, coils, filters, fans, etc. shall be identified.
- C. Exterior (Outdoor) Equipment: Brass nameplates, with engraved black filled letters, not less than 48 mm (3/16-inch) high riveted or bolted to the equipment.

D. Control Items: All temperature, pressure, and controllers shall be labeled and the component's function identified. Identify and label each item as they appear on the control diagrams.

E. Valve Tags and Lists:

1. Plumbing: All valves shall be provided with valve tags and listed on a valve list (Fixture stops not included).
2. Valve tags: Engraved black filled numbers and letters not less than 13 mm (1/2-inch) high for number designation, and not less than 6.4 mm (1/4-inch) for service designation on 19 gage, 38 mm (1-1/2 inches) round brass disc, attached with brass "S" hook or brass chain.
3. Valve lists: Valve lists shall be created using a word processing program and printed on plastic coated cards. The plastic coated valve list card(s), sized 216 mm (8-1/2 inches) by 280 mm (11 inches) shall show valve tag number, valve function and area of control for each service or system. The valve list shall be in a punched 3-ring binder notebook. A copy of the valve list shall be mounted in picture frames for mounting to a wall.
4. A detailed plan for each floor of the building indicating the location and valve number for each valve shall be provided. Each valve location shall be identified with a color coded sticker or thumb tack in ceiling.

2.8 FIRE STOPPING

A. Section 07 84 00, FIRESTOPPING specifies an effective barrier against the spread of fire, smoke and gases where penetrations occur for piping. Refer to Section 23 07 11, HVAC, PLUMBING, AND BOILER PLANT INSULATION, for pipe insulation.

2.9 GALVANIZED REPAIR COMPOUND

A. Mil. Spec. DOD-P-21035B, paint.

2.10 PIPE AND EQUIPMENT SUPPORTS AND RESTRAINTS

A. In lieu of the paragraph which follows, suspended equipment support and restraints may be designed and installed in accordance with the International Building Code (IBC), latest edition, and SECTION 13 05 41, SEISMIC RESTRAINT REQUIREMENTS FOR NON-STRUCTURAL COMPONENTS. Submittals based on the International Building Code (IBC), latest edition, SECTION 13 05 41 requirements, or the following paragraphs of this Section shall be stamped and signed by a professional engineer registered in a state where the project is located. The Support system

- of suspended equipment over 227 kg (500 pounds) shall be submitted for approval of the Resident Engineer in all cases. See these specifications for lateral force design requirements.
- B. Type Numbers Specified: MSS SP-58. For selection and application refer to MSS SP-69. Refer to Section 05 50 00, METAL FABRICATIONS, for miscellaneous metal support materials and prime coat painting.
- C. For Attachment to Concrete Construction:
1. Concrete insert: Type 18, MSS SP-58.
 2. Self-drilling expansion shields and machine bolt expansion anchors: Permitted in concrete not less than 102 mm (4 inches) thick when approved by the Resident Engineer for each job condition.
 3. Power-driven fasteners: Permitted in existing concrete or masonry not less than 102 mm (4 inches) thick when approved by the Resident Engineer for each job condition.
- D. For Attachment to Steel Construction: MSS SP-58.
1. Welded attachment: Type 22.
 2. Beam clamps: Types 20, 21, 28 or 29. Type 23 C-clamp may be used for individual copper tubing up to 23 mm (7/8-inch) outside diameter.
- E. Attachment to Metal Pan or Deck: As required for materials specified in Section 05 31 00, STEEL DECKING, Section 05 36 00, COMPOSITE METAL DECKING.
- F. For Attachment to Wood Construction: Wood screws or lag bolts.
- G. Hanger Rods: Hot-rolled steel, ASTM A36 or A575 for allowable load listed in MSS SP-58. For piping, provide adjustment means for controlling level or slope. Types 13 or 15 turn-buckles shall provide 38 mm (1-1/2 inches) minimum of adjustment and incorporate locknuts. All-thread rods are acceptable.
- H. Multiple (Trapeze) Hangers: Galvanized, cold formed, lipped steel channel horizontal member, not less than 41 mm by 41 mm (1-5/8 inches by 1-5/8 inches), 2.7 mm (No. 12 gage), designed to accept special spring held, hardened steel nuts. Trapeze hangers are not permitted for steam supply and condensate piping.
1. Allowable hanger load: Manufacturers rating less 91kg (200 pounds).
 2. Guide individual pipes on the horizontal member of every other trapeze hanger with 6 mm (1/4-inch) U-bolt fabricated from steel rod. Provide Type 40 insulation shield, secured by two 13 mm (1/2-inch) galvanized steel bands, or insulated calcium silicate shield for insulated piping at each hanger.

I. Pipe Hangers and Supports: (MSS SP-58), use hangers sized to encircle insulation on insulated piping. Refer to Section 23 07 11, HVAC, PLUMBING, and BOILER PLANT INSULATION for insulation thickness. To protect insulation, provide Type 39 saddles for roller type supports or insulated calcium silicate shields. Provide Type 40 insulation shield or insulated calcium silicate shield at all other types of supports and hangers including those for insulated piping.

1. General Types (MSS SP-58):

- a. Standard clevis hanger: Type 1; provide locknut.
- b. Riser clamps: Type 8.
- c. Wall brackets: Types 31, 32 or 33.
- d. Roller supports: Type 41, 43, 44 and 46.
- e. Saddle support: Type 36, 37 or 38.
- f. Turnbuckle: Types 13 or 15.
- g. U-bolt clamp: Type 24.
- h. Copper Tube:
 - 1) Hangers, clamps and other support material in contact with tubing shall be painted with copper colored epoxy paint, plastic coated or taped with isolation tape to prevent electrolysis.
 - 2) For vertical runs use epoxy painted or plastic coated riser clamps.
 - 3) For supporting tube to strut: Provide epoxy painted pipe straps for copper tube or plastic inserted vibration isolation clamps.
 - 4) Insulated Lines: Provide pre-insulated calcium silicate shields sized for copper tube.
- i. Supports for plastic or glass piping: As recommended by the pipe manufacturer with black rubber tape extending one inch beyond steel support or clamp.
- j. Spring hangers are required on all plumbing system pumps one horsepower and greater.

2. Plumbing Piping (Other Than General Types):

- a. Horizontal piping: Type 1, 5, 7, 9, and 10.
- b. Chrome plated piping: Chrome plated supports.

- c. Hangers and supports in pipe chase: Prefabricated system ABS self-extinguishing material, not subject to electrolytic action, to hold piping, prevent vibration and compensate for all static and operational conditions.
 - d. Blocking, stays and bracing: Angle iron or preformed metal channel shapes, 1.3 mm (18 gage) minimum.
- J. Pre-insulated Calcium Silicate Shields:
- 1. Provide 360 degree water resistant high density 965 kPa (140 psi) compressive strength calcium silicate shields encased in galvanized metal.
 - 2. Pre-insulated calcium silicate shields to be installed at the point of support during erection.
 - 3. Shield thickness shall match the pipe insulation.
 - 4. The type of shield is selected by the temperature of the pipe, the load it must carry, and the type of support it will be used with.
 - a. Shields for supporting cold water shall have insulation that extends a minimum of one inch past the sheet metal.
 - b. The insulated calcium silicate shield shall support the maximum allowable water filled span as indicated in MSS-SP 69. To support the load, the shields shall have one or more of the following features: structural inserts 4138 kPa (600 psi) compressive strength, an extra bottom metal shield, or formed structural steel (ASTM A36) wear plates welded to the bottom sheet metal jacket.
 - 5. Shields may be used on steel clevis hanger type supports, roller supports or flat surfaces.
- K. Seismic Restraint of Piping: Refer to Section 13 05 41,
SEISMIC RESTRAINT REQUIREMENTS FOR NON-STRUCTURAL COMPONENTS.

2.11 PIPE PENETRATIONS

- A. Pipe penetration sleeves shall be installed for all pipe other than rectangular blocked out floor openings for risers in mechanical bays.
- B. Pipe penetration sleeve materials shall comply with all fire stopping requirements for each penetration.
- C. To prevent accidental liquid spills from passing to a lower level, provide the following:
 - 1. For sleeves: Extend sleeve 25 mm (1 inch) above finished floor and provide sealant for watertight joint.

2. For blocked out floor openings: Provide 40 mm (1-1/2 inch) angle set in silicone adhesive around opening.
 3. For drilled penetrations: Provide 40 mm (1-1/2 inch) angle ring or square set in silicone adhesive around penetration.
- C. Penetrations are not allowed through beams or ribs, but may be installed in concrete beam flanges. Any deviation from these requirements must receive prior approval of Resident Engineer.
 - D. Sheet metal, plastic, or moisture resistant fiber sleeves shall be provided for pipe passing through floors, interior walls, and partitions, unless brass or steel pipe sleeves are specifically called for below.
 - E. Cast iron or zinc coated pipe sleeves shall be provided for pipe passing through exterior walls below grade. The space between the sleeve and pipe shall be made watertight with a modular or link rubber seal. The link seal shall be applied at both ends of the sleeve.
 - F. Galvanized steel or an alternate black iron pipe with asphalt coating sleeves shall be for pipe passing through concrete beam flanges, except where brass pipe sleeves are called for. A galvanized steel Sleeve shall be provided for pipe passing through floor of mechanical rooms, laundry work rooms, and animal rooms above basement. Except in mechanical rooms, sleeves shall be connected with a floor plate.
 - G. Brass Pipe Sleeves shall be provided for pipe passing through quarry tile, terrazzo or ceramic tile floors. The sleeve shall be connected with a floor plate.
 - H. Sleeve clearance through floors, walls, partitions, and beam flanges shall be 25 mm (1 inch) greater in diameter than external diameter of pipe. Sleeve for pipe with insulation shall be large enough to accommodate the insulation plus 25 mm (1 inch) in diameter. Interior openings shall be caulked tight with fire stopping material and sealant to prevent the spread of fire, smoke, and gases.
 - I. Sealant and Adhesives: Shall be as specified in Section 07 92 00, JOINT SEALANTS.

2.12 TOOLS AND LUBRICANTS

- A. Furnish, and turn over to the Resident Engineer, special tools not readily available commercially, that are required for disassembly or adjustment of equipment and machinery furnished.
- B. Grease Guns with Attachments for Applicable Fittings: One for each type of grease required for each motor or other equipment.

04-11

- C. Tool Containers: metal, 22 05 11 - 15 permanently identified for

intended service and mounted, or located, where directed by the Resident Engineer.

- D. Lubricants: A minimum of 0.95 L (1 quart) of oil, and 0.45 kg (1 pound) of grease, of equipment manufacturer's recommended grade and type, in unopened containers and properly identified as to use for each different application.

2.13 WALL, FLOOR AND CEILING PLATES

- A. Material and Type: Chrome plated brass or chrome plated steel, one piece or split type with concealed hinge, with set screw for fastening to pipe, or sleeve. Use plates that fit tight around pipes, cover openings around pipes and cover the entire pipe sleeve projection.
- B. Thickness: Not less than 2.4 mm (3/32-inch) for floor plates. For wall and ceiling plates, not less than 0.64 mm (0.025-inch) for up to 80 mm (3 inch) pipe, 0.89 mm (0.035-inch) for larger pipe.
- C. Locations: Use where pipe penetrates floors, walls and ceilings in exposed locations, in finished areas only. Wall plates shall be used where insulation ends on exposed water supply pipe drop from overhead. A watertight joint shall be provided in spaces where brass or steel pipe sleeves are specified.

2.14 ASBESTOS

Materials containing asbestos are not permitted.

PART 3 - EXECUTION

3.1 ARRANGEMENT AND INSTALLATION OF EQUIPMENT AND PIPING

- A. Location of piping, sleeves, inserts, hangers, and equipment, access provisions shall be coordinated with the work of all trades. Piping, sleeves, inserts, hangers, and equipment shall be located clear of windows, doors, openings, light outlets, and other services and utilities. Equipment layout drawings shall be prepared to coordinate proper location and personnel access of all facilities. The drawings shall be submitted for review.

Manufacturer's published recommendations shall be followed for installation methods not otherwise specified.

- B. Operating Personnel Access and Observation Provisions: All equipment and systems shall be arranged to provide clear view and easy access, without use of portable ladders, for maintenance and operation of all devices including, but not limited to: all equipment items, valves, filters, strainers, transmitters, sensors, control devices. All gages and indicators shall be clearly visible by personnel standing on the

floor or on permanent platforms. Maintenance and operating space and access provisions that are shown on the drawings shall not be changed nor reduced.

- C. Structural systems necessary for pipe and equipment support shall be coordinated to permit proper installation.
- D. Location of pipe sleeves, trenches and chases shall be accurately coordinated with equipment and piping locations.
- E. Cutting Holes:
 - 1. Holes through concrete and masonry shall be cut by rotary core drill. Pneumatic hammer, impact electric, and hand or manual hammer type drill will not be allowed, except as permitted by RE/COTR where working area space is limited.
 - 2. Holes shall be located to avoid interference with structural members such as beams or grade beams. Holes shall be laid out in advance and drilling done only after approval by RE/COTR. If the Contractor considers it necessary to drill through structural members, this matter shall be referred to RE/COTR for approval.
 - 3. Waterproof membrane shall not be penetrated. Pipe floor penetration block outs shall be provided outside the extents of the waterproof membrane.
- F. Interconnection of Instrumentation or Control Devices: Generally, electrical and pneumatic interconnections are not shown but must be provided.
- G. Minor Piping: Generally, small diameter pipe runs from drips and drains, water cooling, and other service are not shown but must be provided.
- H. Protection and Cleaning:
 - 1. Equipment and materials shall be carefully handled, properly stored, and adequately protected to prevent damage before and during installation, in accordance with the manufacturer's recommendations and as approved by the Resident Engineer. Damaged or defective items in the opinion of the Resident Engineer, shall be replaced.
 - 2. Protect all finished parts of equipment, such as shafts and bearings where accessible, from rust prior to operation by means of protective grease coating and wrapping. Close pipe openings with caps or plugs during installation. Pipe openings, equipment, and plumbing fixtures shall be tightly covered against dirt or

mechanical injury. At completion of all work thoroughly clean fixtures, exposed materials and equipment.

- I. Concrete and Grout: Concrete and shrink compensating grout 25 MPa (3000 psi) minimum, specified in Section 03 30 00, CAST-IN-PLACE CONCRETE. shall be used for all pad or floor mounted equipment. Gages, thermometers, valves and other devices shall be installed with due regard for ease in reading or operating and maintaining said devices. Thermometers and gages shall be located and positioned to be easily read by operator or staff standing on floor or walkway provided. Servicing shall not require dismantling adjacent equipment or pipe work.
- J. Interconnection of Controls and Instruments: Electrical interconnection is generally not shown but shall be provided. This includes interconnections of sensors, transmitters, transducers, control devices, control and instrumentation panels, instruments and computer workstations. Comply with NFPA-70.
- K. Many plumbing systems interface with the HVAC control system. See the HVAC control points list and section 23 09 23 DIRECT DIGITAL CONTROLS FOR HVAC
- L. Work in bathrooms, restrooms, housekeeping closets: All pipe penetrations behind escutcheons shall be sealed with plumbers putty.
- M. Switchgear Drip Protection: Every effort shall be made to eliminate the installation of pipe above electrical and telephone switchgear. If this is not possible, encase pipe in a second pipe with a minimum of joints.
- N. Inaccessible Equipment:
 - 1. Where the Government determines that the Contractor has installed equipment not conveniently accessible for operation and maintenance, equipment shall be removed and reinstalled or remedial action performed as directed at no additional cost to the Government.
 - 2. The term "conveniently accessible" is defined as capable of being reached without the use of ladders, or without climbing or crawling under or over obstacles such as electrical conduit, motors, fans, pumps, belt guards, transformers, high voltage lines, piping, and ductwork.

3.2 TEMPORARY PIPING AND EQUIPMENT

- A. Continuity of operation of existing facilities may require temporary installation or relocation of equipment and piping. Temporary equipment or pipe installation or relocation shall be provided to maintain continuity of operation of existing facilities.
- B. The Contractor shall provide all required facilities in accordance with the requirements of phased construction and maintenance of service. All piping and equipment shall be properly supported, sloped to drain, operate without excessive stress, and shall be insulated where injury can occur to personnel by contact with operating facilities. The requirements of Paragraph 3.1 shall apply.
- C. Temporary facilities and piping shall be completely removed and any openings in structures sealed. Necessary blind flanges and caps shall be provided to seal open piping remaining in service.

3.3 RIGGING

- A. Openings in building structures shall be planned to accommodate design scheme.
- B. Alternative methods of equipment delivery may be offered and will be considered by Government under specified restrictions of phasing and service requirements as well as structural integrity of the building.
- C. All openings in the building shall be closed when not required for rigging operations to maintain proper environment in the facility for Government operation and maintenance of service.
- D. Contractor shall provide all facilities required to deliver specified equipment and place on foundations. Attachments to structures for rigging purposes and support of equipment on structures shall be Contractor's full responsibility.
- E. Contractor shall check all clearances, weight limitations and shall provide a rigging plan designed by a Registered Professional Engineer. All modifications to structures, including reinforcement thereof, shall be at Contractor's cost, time and responsibility.
- F. Rigging plan and methods shall be referred to RE/COTR for evaluation prior to actual work.

3.4 PIPE AND EQUIPMENT SUPPORTS

- A. Where hanger spacing does not correspond with joist or rib spacing, use structural steel channels secured directly to joist and rib structure that will correspond to the required hanger spacing, and then suspend the equipment and piping from the channels. Holes shall be drilled or

burned in structural steel ONLY with the prior written approval of the Resident Engineer.

- B. The use of chain pipe supports, wire or strap hangers; wood for blocking, stays and bracing, or hangers suspended from piping above shall not be permitted. Rusty products shall be replaced.
- C. Hanger rods shall be used that are straight and vertical. Turnbuckles for vertical adjustments may be omitted where limited space prevents use. A minimum of 15 mm (1/2-inch) clearance between pipe or piping covering and adjacent work shall be provided.
- D. For horizontal and vertical plumbing pipe supports, refer to the UPC-2009, latest edition, and these specifications.
- E. Overhead Supports:
 - 1. The basic structural system of the building is designed to sustain the loads imposed by equipment and piping to be supported overhead.
 - 2. Provide steel structural members, in addition to those shown, of adequate capability to support the imposed loads, located in accordance with the final approved layout of equipment and piping.
 - 3. Tubing and capillary systems shall be supported in channel troughs.
- F. Floor Supports:
 - 1. Provide concrete bases, concrete anchor blocks and pedestals, and structural steel systems for support of equipment and piping. Concrete bases and structural systems shall be anchored and doweled to resist forces under operating and seismic conditions (if applicable) without excessive displacement or structural failure.
 - 2. Bases and supports shall not be located and installed until equipment mounted thereon has been approved. Bases shall be sized to match equipment mounted thereon plus 50 mm (2 inch) excess on all edges. Structural drawings shall be reviewed for additional requirements. Bases shall be neatly finished and smoothed, shall have chamfered edges at the top, and shall be suitable for painting.
 - 3. All equipment shall be shimmed, leveled, firmly anchored, and grouted with epoxy grout. Anchor bolts shall be placed in sleeves, anchored to the bases. Fill the annular space between sleeves and bolts with a grout material to permit alignment and realignment.
 - 4. For seismic anchoring, refer to Section 13 05 41, SEISMIC RESTRAINT REQUIREMENTS FOR NON-STRUCTURAL COMPONENTS.

3.5 LUBRICATION

- A. All equipment and devices requiring lubrication shall be lubricated prior to initial operation. All devices and equipment shall be field checked for proper lubrication.
- B. All devices and equipment shall be equipped with required lubrication fittings. A minimum of one liter (one quart) of oil and 0.5 kg (one pound) of grease of manufacturer's recommended grade and type for each different application shall be provided. All materials shall be delivered to RE/COTR in unopened containers that are properly identified as to application.
- C. A separate grease gun with attachments for applicable fittings shall be provided for each type of grease applied.
- D. All lubrication points shall be accessible without disassembling equipment, except to remove access plates.
- E. All lubrication points shall be extended to one side of the equipment.

3.6 CLEANING AND PAINTING

- A. Prior to final inspection and acceptance of the plant and facilities for beneficial use by the Government, the plant facilities, equipment and systems shall be thoroughly cleaned and painted. Refer to Section 09 91 00, PAINTING.
- B. In addition, the following special conditions apply:
 - 1. Cleaning shall be thorough. Solvents, cleaning materials and methods recommended by the manufacturers shall be used for the specific tasks. All rust shall be removed prior to painting and from surfaces to remain unpainted. Scratches, scuffs, and abrasions shall be repaired prior to applying prime and finish coats.
 - 2. The following Material And Equipment shall NOT be painted::
 - a. Motors, controllers, control switches, and safety switches.
 - b. Control and interlock devices.
 - c. Regulators.
 - d. Pressure reducing valves.
 - e. Control valves and thermostatic elements.
 - f. Lubrication devices and grease fittings.
 - g. Copper, brass, aluminum, stainless steel and bronze surfaces.
 - h. Valve stems and rotating shafts.
 - i. Pressure gages and thermometers.
 - j. Glass.
 - k. Name plates.

3. Control and instrument panels shall be cleaned and damaged surfaces repaired. Touch-up painting shall be made with matching paint obtained from manufacturer or computer matched.
4. Pumps, motors, steel and cast iron bases, and coupling guards shall be cleaned, and shall be touched-up with the same color as utilized by the pump manufacturer
5. Temporary Facilities: Apply paint to surfaces that do not have existing finish coats.
6. The final result shall be a smooth, even-colored, even-textured factory finish on all items. The entire piece of equipment shall be repainted, if necessary, to achieve this.

3.7 IDENTIFICATION SIGNS

- A. Laminated plastic signs, with engraved lettering not less than 5 mm (3/16-inch) high, shall be provided that designates equipment function, for all equipment, switches, motor controllers, relays, meters, control devices, including automatic control valves. Nomenclature and identification symbols shall correspond to that used in maintenance manual, and in diagrams specified elsewhere. Attach by chain, adhesive, or screws.
- B. Factory Built Equipment: Metal plate, securely attached, with name and address of manufacturer, serial number, model number, size, performance shall be placed on factory built equipment.
- C. Pipe Identification: Refer to Section 09 91 00, PAINTING.

3.8 STARTUP AND TEMPORARY OPERATION

- A. Start up of equipment shall be performed as described in the equipment specifications. Vibration within specified tolerance shall be verified prior to extended operation. Temporary use of equipment is specified in Section 01 00 00, GENERAL REQUIREMENTS, Article, TEMPORARY USE OF MECHANICAL AND ELECTRICAL EQUIPMENT.

3.9 OPERATING AND PERFORMANCE TESTS

- A. Prior to the final inspection, all required tests shall be performed as specified in Section 01 00 00, GENERAL REQUIREMENTS, Article, TESTS and submit the test reports and records to the Resident Engineer.
- B. Should evidence of malfunction in any tested system, or piece of equipment or component part thereof, occur during or as a result of tests, make proper corrections, repairs or replacements, and repeat tests at no additional cost to the Government.

- C. When completion of certain work or system occurs at a time when final control settings and adjustments cannot be properly made to make performance tests, then make performance tests such systems respectively during first actual seasonal use of respective systems following completion of work.

3.10 OPERATION AND MAINTENANCE MANUALS

- A. Provide four bound copies. The Operations and maintenance manuals shall be delivered to RE/COTR not less than 30 days prior to completion of a phase or final inspection.
- B. All new and temporary equipment and all elements of each assembly shall be included.
- C. Data sheet on each device listing model, size, capacity, pressure, speed, horsepower, impeller size, and other information shall be included.
- D. Manufacturer's installation, maintenance, repair, and operation instructions for each device shall be included. Assembly drawings and parts lists shall also be included. A summary of operating precautions and reasons for precautions shall be included in the Operations and Maintenance Manual.
- E. Lubrication instructions, type and quantity of lubricant shall be included.
- F. Schematic diagrams and wiring diagrams of all control systems corrected to include all field modifications shall be included.
- G. Set points of all interlock devices shall be listed.
- H. Trouble-shooting guide for the control system troubleshooting guide shall be inserted into the Operations and Maintenance Manual.
- I. The combustion control system sequence of operation corrected with submittal review comments shall be inserted into the Operations and Maintenance Manual.
- J. Emergency procedures.

3.11 INSTRUCTIONS TO VA PERSONNEL

Instructions shall be provided in accordance with Article, INSTRUCTIONS, of Section 01 00 00, GENERAL REQUIREMENTS.

- - - E N D - - -

SECTION 22 05 12
GENERAL MOTOR REQUIREMENTS FOR PLUMBING EQUIPMENT

PART 1 - GENERAL

1.1 DESCRIPTION:

This section describes the general motor requirements for plumbing equipment.

1.2 RELATED WORK:

- A. Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS: General electrical requirements common to more than one section of Division 26.
- B. 26 29 11, LOW-VOLTAGE MOTOR STARTERS: Starters, control and protection of motors: Section
- C. Section 26 24 19, MOTOR-CONTROL CENTERS: Motor Control Centers.

1.3 SUBMITTALS:

- A. In accordance with Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS, submit the following:
- B. Shop Drawings:
 - 1. Sufficient information, clearly presented, shall be included to determine compliance with drawings and specifications.
 - 2. Motor nameplate information shall be submitted including electrical ratings, dimensions, mounting details, materials, horsepower, power factor, current as a function of speed, current efficiency, speed as a function of load, RPM, enclosure, starting characteristics, torque characteristics, code letter, full load and locked rotor current, service factor, and lubrication method.
 - 3. Motor parameters required for the determination of the Reed Critical Frequency of vertical hollow shaft motors shall be submitted.
- C. Manuals:
 - 1. Companion copies of complete maintenance and operating manuals, including technical data sheets and application data shall be submitted simultaneously with the shop drawings.
- D. Certification: Two weeks prior to final inspection, unless otherwise noted, four copies of the following certification shall be submitted to the COTR:
 - 1. Certification shall be submitted stating that the motors have been properly applied, installed, adjusted, lubricated, and tested.

1.4 APPLICABLE PUBLICATIONS:

- A. The publications listed below (including amendments, addenda, revisions, supplements and errata) shall form a part of this specification to the extent referenced. Publications are referenced in the text by designation only.
- B. National Electrical Manufacturers Association (NEMA):
 MG 1-07Motors and Generators
 MG 2-01Safety Standard and Guide for Selection,
 Installation and Use of Electric Motors and
 Generators
- C. National Fire Protection Association (NFPA):
 70-08National Electrical Code (NEC)

PART 2 - PRODUCTS**2.1 MOTORS:**

- A. For alternating current, fractional and integral horsepower motors, NEMA Publications MG 1 and MG 2 shall apply.
- B. Voltage ratings shall be as follows:
1. Single phase:
 - a. Motors connected to 120-volt systems: 115 volts.
 - b. Motors connected to 208-volt systems: 200 volts.
 - c. Motors connected to 240 volt or 480 volt systems: 230/460 volts, dual connection.
 2. Three phase:
 - a. Motors connected to 208-volt systems: 200 volts.
 - b. Motors, less than 74.6 kW (100 HP), connected to 240 volt or 480 volt systems: 230/460 volts, dual connection.
 - c. Motors, 74.6 kW (100 HP) or larger, connected to 240-volt systems: 230 volts.
 - d. Motors, 74.6 kW (100 HP) or larger, connected to 480-volt systems: 460 volts.
 - e. Motors connected to high voltage systems: Shall conform to NEMA Standards for connection to the nominal system voltage shown on the drawings.
- C. Number of phases shall be as follows:
1. Motors, less than 373 W (1/2 HP): Single phase.
 2. Motors, 373 W (1/2 HP) and larger: 3 phase.
 3. Exceptions:
 - a. Hermetically sealed motors.

- b. Motors for equipment assemblies, less than 746 W (1 HP), may be single phase provided the manufacturer of the proposed assemblies cannot supply the assemblies with three phase motors.
- D. Horsepower ratings shall be adequate for operating the connected loads continuously in the prevailing ambient temperatures in areas where the motors are installed, without exceeding the NEMA standard temperature rises for the motor insulation.
- E. Motor designs, as indicated by the NEMA code letters, shall be coordinated with the connected loads to assure adequate starting and running torque.
- F. Motor Enclosures:
- 1. Shall be the NEMA types shown on the drawings for the motors.
 - 2. Where the types of motor enclosures are not shown on the drawings, they shall be the NEMA types, which are most suitable for the environmental conditions where the motors are being installed.
 - 3. Enclosures shall be primed and finish coated at the factory with manufacturer's prime coat and standard finish.
 - 4. All motors in hazardous locations shall be approved for the application and meet the Class and Group as required by the area classification.
- G. Electrical Design Requirements
- 1. Motors shall be continuous duty.
 - 2. The insulation system shall be rated minimum of class B, 130° C (266° F).
 - 3. The maximum temperature rise by resistance at rated power shall not exceed Class B limits, 80° C (176° F).
 - 4. The speed/torque and speed/current characteristics shall comply with NEMA Design A or B, as specified.
 - 5. Motors shall be suitable for full voltage starting, unless otherwise noted.
 - 6. Motors for variable frequency drive applications shall adhere to NEMA standards publication MG 1, Part 30, Application considerations for Constant Speed Motors Used on a Sinusoidal Bus with Harmonic Content and General Purpose Motors Used with Adjustable voltage or Adjustable frequency controls, or both, or Part 31, Definite Purpose Inverter Fed Polyphase Motors.

H. Mechanical Design Requirements

1. Bearings shall be rated for a minimum of 26,280 hours L-10 life at full load direct coupled, except vertical high thrust motors.
2. Vertical motors shall be capable of withstanding a momentary up thrust of at least 30% of normal down thrust.
3. Grease lubricated bearings shall be designed for electric motor use. Grease shall be capable of the temperatures associated with electric motors and shall be compatible with Polyurea based greases.
4. Grease fittings, if provided, shall be Alemite type or equivalent.
5. Oil lubricated bearings, when specified, shall have an externally visible sight glass to view oil level.
6. Vibration shall not exceed 0.15 inch per second, unfiltered peak.
7. Noise level shall meet the requirements of the application.
8. Motors on 180 frames and larger shall have provisions for lifting eyes or lugs capable of a safety factor of 5.
9. All external fasteners shall be corrosion resistant.
10. Condensation heaters, when specified, shall keep motor windings at least 5° C (41° F) above ambient temperature.
11. Winding thermostats, when specified shall be normally closed, connected in series.
12. Grounding provisions shall be in the main terminal box.

I. Additional requirements for specific motors, as indicated in other sections, shall also apply.

J. NEMA Premium Efficiency Electric Motors, Motor Efficiencies: All permanently wired polyphase motors of 746 Watts (1 Horsepower) or more shall meet the minimum full-load efficiencies as indicated in the following table, and as specified in this specification. Motors of 746 Watts (one horsepower) or more with open, drip-proof or totally enclosed fan-cooled enclosures shall be NEMA premium efficiency type, unless otherwise indicated. Motors provided as an integral part of motor driven equipment are excluded from this requirement if a minimum seasonal or overall efficiency requirement is indicated for that equipment by the provisions of another section.

Minimum Efficiencies Open Drip-Proof				Minimum Efficiencies Totally Enclosed Fan-Cooled			
Rating kw (HP)	1200 RPM	1800 RPM	3600 RPM	Rating kw (HP)	1200 RPM	1800 RPM	3600 RPM
0.746 (1)	82.5%	85.5%	77.0%	0.746 (1)	82.5%	85.5%	77.0%
1.12 (1.5)	86.5%	86.5%	84.0%	1.12 (1.5)	87.5%	86.5%	84.0%
1.49 (2)	87.5%	86.5%	85.5%	1.49 (2)	88.5%	86.5%	85.5%
2.24 (3)	88.5%	89.5%	85.5%	2.24 (3)	89.5%	89.5%	86.5%
3.73 (5)	89.5%	89.5%	86.5%	3.73 (5)	89.5%	89.5%	88.5%
5.60 (7.5)	90.2%	91.0%	88.5%	5.60 (7.5)	91.0%	91.7%	89.5%
7.46 (10)	91.7%	91.7%	89.5%	7.46 (10)	91.0%	91.7%	90.2%
11.2 (15)	91.7%	93.0%	90.2%	11.2 (15)	91.7%	92.4%	91.0%
14.9 (20)	92.4%	93.0%	91.0%	14.9 (20)	91.7%	93.0%	91.0%
18.7 (25)	93.0%	93.6%	91.7%	18.7 (25)	93.0%	93.6%	91.7%
22.4 (30)	93.6%	94.1%	91.7%	22.4 (30)	93.0%	93.6%	91.7%
29.8 (40)	94.1%	94.1%	92.4%	29.8 (40)	94.1%	94.1%	92.4%
37.3 (50)	94.1%	94.5%	93.0%	37.3 (50)	94.1%	94.5%	93.0%
44.8 (60)	94.5%	95.0%	93.6%	44.8 (60)	94.5%	95.0%	93.6%
56.9 (75)	94.5%	95.0%	93.6%	56.9 (75)	94.5%	95.4%	93.6%
74.6 (100)	95.0%	95.4%	93.6%	74.6 (100)	95.0%	95.4%	94.1%
93.3 (125)	95.0%	95.4%	94.1%	93.3 (125)	95.0%	95.4%	95.0%
112 (150)	95.4%	95.8%	94.1%	112 (150)	95.8%	95.8%	95.0%
149.2 (200)	95.4%	95.8%	95.0%	149.2 (200)	95.8%	96.2%	95.4%

K. Minimum Power Factor at Full Load and Rated Voltage: 90 percent at 1200 RPM, 1800 RPM and 3600 RPM. Power factor correction capacitors shall be installed unless the motor is controlled by a variable frequency drive. The power factor correction capacitors shall be able to withstand high voltage transients and power line variations without breakdown.

PART 3 - EXECUTION

3.1 INSTALLATION:

Install motors in accordance with manufacturer's recommendations, the NEC, NEMA, as shown on the drawings and/or as required by other sections of these specifications.

3.2 FIELD TESTS

Megger all motors after installation, before start-up. All shall test free from grounds.

- - - E N D - - -

SECTION 22 05 19

METERS AND GAGES FOR PLUMBING PIPING

PART 1 - GENERAL

1.1 DESCRIPTION

This section describes the requirements for water meters and pressure gages.

1.2 RELATED WORK

Section 22 05 11, COMMON WORK RESULTS FOR PLUMBING.

1.3 SUBMITTALS

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, and SAMPLES.
- B. Manufacturer's Literature and Data:
 - 1. Water Meter.
 - 2. Pressure Gages.
 - 3. BACnet communication protocol
 - 4. Product certificates for each type of meter and gauge
- C. Operations and Maintenance manual shall include:
 - 1. System Description
 - 2. Major assembly block diagrams
 - 3. Troubleshooting and preventive maintenance guidelines
 - 4. Spare parts information.
- D. Shop Drawings shall include the following:
 - 1. One line, wiring and terminal diagrams including terminals identified, protocol or communication modules, and Ethernet connections.

1.4 APPLICABLE PUBLICATIONS

- A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.
- B. American National Standards Institute (ANSI):
 - American Society of Mechanical Engineers (ASME): (Copyrighted Society)
 - B40.1-05 Gauges-Pressure Indicating Dial Type-Elastic
- C. American Water Works Association (AWWA):
 - C700-07 (R 2003) Standard for Cold Water Meters, Displacement Type, Bronze Main Case

C701-07 Cold Water Meters-Turbine Type, for Customer
Service AWWA/ ANSI

C702-01 Cold water meters - Compound Type

D. International Code Council (ICC):

IPC-06 (2007 Supplement) International Plumbing Code

1.5 AS-BUILT DOCUMENTATION

- A. The electronic documentation and copies of the Operations and Maintenance Manual, approved submittals, shop drawings, and other closeout documentation shall be prepared by a computer software program complying with Section 508 of the Rehabilitation Act of 1973, as amended (29 U.S.C 794d). The manufacturer or vendor of the software used to prepare the electronic documentation shall have a Voluntary Product Accessibility Template made available for review and included as part of the Operations and Maintenance Manual or closeout documentation. All available accessibility functions listed in the Voluntary Accessibility Template shall be enabled in the prepared electronic files. As Adobe Acrobat is a common industry format for such documentation, following the document, "Creating Accessible Adobe PDF files, A Guide for Document Authors" that is maintained and made available by Adobe free of charge is recommended."
- B. Four sets of manufacturer's literature and data updated to include submittal review comments and any equipment substitutions.
- C. Four sets of operation and maintenance data updated to include submittal review comments shall be inserted into a three ring binder. All aspects of system operation and maintenance procedures, including piping isometrics, wiring diagrams of all circuits, a written description of system design, control logic, and sequence of operation shall be included in the operation and maintenance manual. The operations and maintenance manual shall include troubleshooting techniques and procedures for emergency situations. Notes on all special systems or devices such as damper and door closure interlocks shall be included. A List of recommended spare parts (manufacturer, model number, and quantity) shall be furnished. Information explaining any special knowledge or tools the owner will be required to employ shall be inserted into the As-Built documentation.

PART 2 – PRODUCTS

2.1 TURBINE WATER METER

- A. The water meter shall be Turbine type, Class II, in-line, horizontal axis, and fully conform to AWWA C701. The meter Register shall indicate flow in liters (U.S. gallons).
- B. The water meter shall be rated for use at temperatures ranging from -40° C (-40° F) and +70° C (158° F) and operate at a working pressure of 1034 kPa (150-psig).
- C. The turbine case shall be constructed of bronze.
- D. The register box rings and lid shall be made of cast copper alloy containing not less than 75% copper. Forged or die cast copper alloy containing not less than 75% copper or a suitable synthetic polymer.
- E. The flow measuring turbine shall be made of vulcanized hard rubber or suitable synthetic polymer with specific gravity approximately equal to that of water. The measuring turbine shall have sufficient dimensional stability to retain operating clearances at the full range of working temperatures.
- F. All external case closures, such as rings, clamps, screws, bolts, cap bolts, nuts and washers shall be designed for easy removal following lengthy service.
- G. The turbine meter shall have flanged ends and supplied with companion flanges, gaskets, and with bolts and nuts. The companion flanges shall be made of cast iron.
- H. The meter shall not register less than 97% and not more than 103% of the water actually passing through it at any rate of flow within the normal test flow limits specified in AWWA 701.

2.2 WATER METER STRAINER

- A. All meters sizes 50 mm or DN50 (2 inches) and above, shall be fitted with a bronze inlet strainer with top access. The strainer shall conform to AWWA 702.

2.3 WATER METER PROGRAMMING

- A. All meters 50 mm or DN50 (2 inches) and above shall be programmable with software supplied by the meter manufacturer.
- B. The software shall have a Microsoft based interface and operate on the latest Windows operating system. The software shall allow the user to configure the meter, troubleshoot the meter, query and display meter parameters, and configure data and stored values.

- C. The meter firmware shall be upgradeable through one of the communication ports without removing the unit from service.
- D. the meter shall include output for analog 4-20 milliamp signals and binary output.
- E. The meter shall have two dry contact relays outputs for alarm or control functions.

2.4 WATER METER COMMUNICATION PROTOCOL

- A. The meter shall use a native BACnet Ethernet communication protocol. The communications shall be protected against surges induced on its communications channels.

2.5 PRESSURE GAGES FOR WATER AND SEWAGE USAGE

- A. ANSI B40.1 all metal case 114 mm (4-1/2 inches) diameter, bottom connected throughout, graduated as required for service, and identity labeled. Range shall be 0 to 1375 kPa (0 to 200 psi) gauge.
- B. The pressure element assembly shall be bourdon tube. The mechanical movement shall be lined to pressure element and connected to pointer.
- C. The dial shall be non-reflective aluminum with permanently etched scale markings graduated in kPa and psi.
- D. The pointer shall be dark colored metal.
- E. The window shall be glass.
- F. The ring shall be brass or stainless steel.
- G. The accuracy shall be grade A, plus or minus 1 percent of middle half of scale range.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Direct mounted pressure gages shall be installed in piping tees with pressure gage located on pipe at the most readable position.
- B. Valves and snubbers shall be installed in piping for each pressure gage.
- C. Test plugs shall be installed on the inlet and outlet pipes all heat exchangers or water heaters serving more than one plumbing fixture.
- D. Pressure gages shall be installed where indicated on the drawings and at the following locations:
 1. Building water service entrance into building
 2. Inlet and outlet of each pressure reducing valve
 3. Suction and discharge of each domestic water pump or re-circulating hot water return pump.

- E. Water meter installation shall conform to AWWA C700, AWWA C701, and AWWA C702. Electrical installations shall conform to IEEE C2, NFPA 70 (National Electric Code), and to the requirements specified herein. New materials shall be provided.
- F. Each water meter shall communicate with the building energy management and control system and report daily water consumption and peak daily flow rate.

3.2 FIELD QUALITY CONTROL

- A. The meter assembly shall be visually inspected and operationally tested. The correct multiplier placement on the face of the meter shall be verified.

3.3 TRAINING

- A. A training course shall be provided to the medical center on meter configuration and maintenance. Training manuals shall be supplied for all attendee with four additional copies supplied. The training course shall cover meter configuration, troubleshooting, and diagnostic procedures.

- - - E N D - - -

THIS PAGE INTENTIONALLY LEFT BLANK

SECTION 22 05 23
GENERAL-DUTY VALVES FOR PLUMBING PIPING

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This section describes the requirements for general-duty valves for domestic water and sewer systems.

1.2 RELATED WORK

- A. Section 22 05 11, COMMON WORK RESULTS FOR PLUMBING.

1.3 SUBMITTALS

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, and SAMPLES.
- B. Manufacturer's Literature and Data:
1. Valves.
 2. Backflow Preventers.
 3. Pressure Reducing Valves.
 4. Backwater Valves
 5. All items listed in Part 2 - Products.

1.4 APPLICABLE PUBLICATIONS

- A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.
- B. American Society for Testing and Materials (ASTM):A536-84(R 2004) Standard Specification for Ductile Iron Castings
- C. American Society of Sanitary Engineering (ASSE)
 ASSE 1003-01 (R 2003) . Performance Requirements for Water Pressure Reducing Valves
 ASSE 1012-02Backflow Preventer with Intermediate Atmospheric Vent
 ASSE 1013-05 Reduced Pressure Principle Backflow Preventers and Reduced Pressure Fire Protection Principle Backflow Preventers
- D. Uniform Plumbing Code (UPC)
 UPC 2009Uniform Plumbing Code
- E. Manufacturers Standardization Society of the Valve and Fittings Industry, Inc. (MSS):
 SP-25-98 Standard Marking System for Valves, Fittings, Flanges and Unions
 SP-67-02a (R 2004) Butterfly Valve of the Single flange Type (Lug Wafer)

SP-70-06	.....	Cast Iron Gate Valves, Flanged and Threaded Ends.
SP-72-99	.....	Ball Valves With Flanged or Butt Welding For General Purpose
SP-80-03	.....	Bronze Gate, Globe, Angle and Check Valves.
SP-110-96	.....	Ball Valve Threaded, Socket Welding, Solder Joint, Grooved and Flared Ends

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Valves shall be prepared for shipping as follows:
 - 1. Protect internal parts against rust and corrosion.
 - 2. Protect threads, flange faces, grooves, and weld ends.
 - 3. Set angle, gate, and globe valves closed to prevent rattling.
 - 4. Set ball and plug valves open to minimize exposure of functional surfaces
 - 5. Set butterfly valves closed or slightly open.
 - 6. Block check valves in either closed or open position.
- B. Valves shall be prepared for storage as follows:
 - 1. Maintain valve end protection.
 - 2. Store valves indoors and maintain at higher than ambient dew point temperature.
- C. A sling shall be used for large valves. The sling shall be rigged to avoid damage to exposed parts. Hand wheels or stems shall not be used as lifting or rigging points.

PART 2 - PRODUCTS

2.1 VALVES

- A. Asbestos packing and gaskets are prohibited.
- B. Bronze valves shall be made with dezincification resistant materials. Bronze valves made with copper alloy (brass) containing more than 15 percent zinc shall not be permitted.
- C. Valves in insulated piping shall have 50 mm or DN50 (2 inch) stem extensions and extended handles of non-thermal conductive material that allows operating the valve without breaking the vapor seal or disturbing the insulation. Memory stops shall be fully adjustable after insulation is applied.
- D. Exposed Valves over 65 mm or DN65 (2-1/2 inches) installed at an elevation over 3.6 meters (12 feet) shall have a chain-wheel attachment to valve hand-wheel, stem, or other actuator.

E. Ball valves, pressure regulating valves, gate valves, globe valves, and plug valves used to supply potable water shall meet the requirements of NSF 61.

F. Shut-off:

1. Cold, Hot and Re-circulating Hot Water:

a. 50 mm or DN50 (2 inches) and smaller: Ball, MSS SP-72, SP-110, Ball valve shall be full port three piece or two piece with a union design with adjustable stem package. Threaded stem designs are not allowed. The ball valve shall have a SWP rating of 1035 kPa (150 psig) and a CWP rating of 4140 kPa (600 psig). The body material shall be Bronze ASTM B584, Alloy C844. The ends shall be solder,

b. Less than 100 mm DN100 (4 inches): Butterfly shall have an iron body with EPDM seal and aluminum bronze disc. The butterfly valve shall meet MSS SP-67, type I standard. The butterfly valve shall have a SWP rating of 1380 kPa (200 psig). The valve design shall be lug type suitable for bidirectional dead-end service at rated pressure. The body material shall meet ASTM A 536, ductile iron.

c. 100 mm (DN100) (4 inches) and larger:

1) Class 125, OS&Y, Cast Iron Gate Valve. The gate valve shall meet MSS-SP-70 type I standard. The gate valve shall have a CWP rating of 1380 kPa (200 psig). The valve materials shall meet ASTM A 126, grey iron with bolted bonnet, flanged ends, bronze trim, and solid wedge disc. The gate valve shall be gear operated for sizes under 200 mms or DN200 (8 inches) and crank operated for sizes 200 mms or DN200 (8 inches) and above

2) Single flange, ductile iron butterfly valves: The single flanged butterfly valve shall meet the MSS SP-67 standard. The butterfly valve shall have a CWP rating of 1380 kPa (200 psig). The butterfly valve shall be lug type, suitable for bidirectional dead-end service at rated pressure without use of downstream flange. The body material shall comply with ASTM A536 ductile iron. The seat shall be EPDM with stainless steel disc and stem.

3) Grooved end, ductile iron butterfly valves. The grooved butterfly valve shall meet the MSS SP-67 standard. The grooved butterfly valve shall have a CWP rating of 1380 kPa

(200 psig). The valve materials shall be polyamide coated ductile iron conforming to ASTM A536 with two piece stainless steel stem, EPDM encapsulated ductile iron disc, and EPDM seal. The butterfly valve shall be gear operated

2. Reagent Grade Water: Valves for reagent grade, reverse osmosis, or de-ionized water service shall be ball type of same material as used for pipe.

C. Balancing:

1. Hot Water Re-circulating, 80 mm or DN80 (3 inches) and smaller manual balancing valve shall be of bronze body, brass ball construction with glass and carbon filled TFE seat rings and designed for positive shutoff. The manual balancing valve shall have differential pressure read-out ports across the valve seat area. The read out ports shall be fitting with internal EPT inserts and check valves. The valve body shall have 8 mm or DN8 NPT (1/4" NPT) tapped drain and purge port. The valves shall have memory stops that allow the valve to close for service and then reopened to set point without disturbing the balance position. All valves shall have calibrated nameplates to assure specific valve settings.
2. Larger than 80 mm or DN80 (3 inches): Manual balancing valves shall be of heavy duty cast iron flanged construction with 862 kPa (125 psi) flange connections. The flanged manual balancing valves shall have either a brass ball with glass and carbon filled TFE seal rings or fitted with a bronze seat, replaceable bronze disc with EPDM seal insert and stainless steel stem. The design pressure shall be 1207 kPa (175) at 121 deg C (250 deg F).

D. Check:

1. Check valves less than 80 mm or DN80 (3 inches) and smaller) shall be class 125, bronzeswing check valves with non metallic Buna-N disc. The check valve shall meet MSS SP-80 Type 4 standard. The check valve shall have a CWP rating of 1380 kPa (200 psig). The check valve shall have a Y pattern horizontal body design with bronze body material conforming to ASTM B 62, solder joints, and PTFE or TFE disc.
2. Larger than 100 mm or DN100 (4 inches and larger): a. Check valves shall be class 125, iron swing check valve with lever and weight closure control. The check valve shall meet MSS SP-71 Type I standard. The check valve shall have a CWP rating

of 1380 kPa (200 psig). The check valve shall have a clear or full waterway body design with gray iron body material conforming to ASTM A 126, bolted bonnet, flanged ends, bronze trim.

- b. All check valves on the discharge side of submersible sump pumps shall have factory installed exterior level and weight with sufficient weight to prevent the check valve from hammering against the seat when the sump pump stops.

E. Globe:

1. 80 mm or DN80 (3 inches) or smaller: Class 150, bronze globe valve with non metallic disc. The globe valve shall meet MSS SP-80, Type 2 standard. The globe valve shall have a CWP rating of 2070 kPa (300 psig). The valve material shall be bronze with integral seal and union ring bonnet conforming to ASTM B 62 with solder ends, copper-silicon bronze stem, TPFPE or TFE disc, malleable iron hand wheel.
2. Larger than 80 mm or DN80 (3 inches): Similar to above, except with cast iron body and bronze trim, class 125, iron globe valve. The globe valve shall meet MSS SP-85, Type 1 standard. The globe valve shall have a CWP rating of 1380 kPa (200 psig). The valve material shall be gray iron with bolted bonnet conforming to ASTM A 126 with flanged ends, bronze trim, malleable iron handwheel.

2.2 WATER PRESSURE REDUCING VALVE AND CONNECTIONS

- A. 80 mm or DN80 (3 inches) or smaller: The pressure reducing valve shall consist of a bronze body and bell housing, a separate access cover for the plunger, and a bolt to adjust the downstream pressure. The bronze bell housing and access cap shall be threaded to the body and shall not require the use of ferrous screws. The assembly shall be of the balanced piston design and shall reduce pressure in both flow and no flow conditions. The assembly shall be accessible for maintenance without having to remove the body from the line.
- B. 100 mm or DN100 (4 inches) and larger: The pressure reducing valve shall consist of a flanged cast iron body and rated to 1378-kPa (200-psig). The valve shall have a large Hycar diaphragm for sensitive response.
- C. The regulator shall have a tap for pressure gauge.
- D. The regulator shall have a temperature rating of 100° C (210° F) for hot water or hot water return service. Pressure regulators shall have accurate pressure regulation to 6.9-kPa (+/- 1 psig).

- C. Setting: Entering water pressure, discharge pressure, capacity, size, and related measurements shall be as shown on the drawings.
- D. Connections Valves and Strainers: shut off valves shall be installed on each side of reducing valve and a bypass line equal in size to the regulator inlet pipe shall be installed with a normally closed globe valve. A strainer shall be installed on inlet side of, and same size as pressure reducing valve. A pressure gage shall be installed on the low pressure side of the line.

2.3 BACKFLOW PREVENTERS

- A. A backflow prevention assembly shall be installed at any point in the plumbing system where the potable water supply comes in contact with a potential source of contamination. The backflow prevention assembly shall be ASSE 1013 listed and certified.
- B. Reduced pressure backflow preventers shall be installed in the following applications.
 - 1. Deionizers.
 - 2. Sterilizers.
 - 3. Stills.
 - 4. Dialysis, Deionized or Reverse Osmosis Water Systems.
 - 5. Water make up to heating systems, cooling tower, chilled water system, generators, and similar equipment consuming water.
 - 6. Water service entrance from loop system.
 - 7. Dental Equipment
 - 8. Power washer
 - 9. Atmospheric Vacuum Breaker: ASSE 1001
 - a. Hose bibs and sinks w/threaded outlets.
 - b. Disposers.
 - c. Showers (telephone type).
 - d. Hydrotherapy units.
 - e. Autopsy, on each hot and cold water outlet at each table or sink.
 - f. All kitchen equipment, if not protected by air gap.
 - g. Ventilating hoods with wash down system.
 - h. Film processor.
 - i. Detergent system
 - j. Dental equipment
 - k. Fume hoods
 - l. Glassware washers

- C. The reduced pressure principle backflow prevention assembly shall be ASSE listed 1013 with full port OS&Y gate valves and an integral relief monitor switch. The main body and access cover shall be epoxy coated duct iron conforming to ASTM A536 grade 4. The seat ring and check valve shall be Noryl (NSF listed). The stem shall be stainless steel conforming to ASTM A276. The seat disc elastomer shall be EPDM. The checks and the relief valve shall be accessible for maintenance without removing the device from the line. An epoxy coated wye type strainer with flanged connections shall be installed on the inlet.
- D. The atmospheric vacuum breaker shall be ASSE listed 1001. The main body shall be either cast bronze. All internal polymers shall be NSF listed. The seat disc elastomer shall be silicone. The device shall be accessible for maintenance without removing the device from the service line. The installation shall not be in a concealed or inaccessible location or where the venting of water from the device during normal operation is deemed objectionable.

2.4 CHAINWHEELS

- A. Valve chain wheel assembly with sprocket rim brackets and chain shall be constructed according to the following:
 - 1. Brackets: type, number, size, and fasteners required to mount actuator on valve.
 - 2. Attachment: For connection to ball butterfly valve stem.
 - 3. Sprocket rim with chain guides: Bronze of type and size required for valve with zinc coating.
 - 4. Chain: Hot dipped galvanized steel of size required to fit sprocket rim.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Valve interior shall be examined for cleanliness, freedom from foreign matter, and corrosion. Special packing materials shall be removed, such as blocks, used to prevent disc movement during shipping and handling.
- B. Valves shall be operated in positions from fully open to fully closed. Guides and seats shall be examined and made accessible by such operations.
- C. Threads on valve and mating pipe shall be examined for form and cleanliness.

D. Mating flange faces shall be examined for conditions that might cause leakage. Bolting shall be checked for proper size, length, and material. Gaskets shall be verified for proper size and that its material composition is suitable for service and free from defects and damage.

E. Do not attempt to repair defective valves; replace with new valves.

3.2 VALVE INSTALLATION

A. Install valves with unions or flanges at each piece of equipment arranged to allow service, maintenance, and equipment removal without system shutdown.

B. Valves shall be located for easy access and shall be provide with separate support. Valves shall be accessible with access doors when installed inside partitions or above hard ceilings.

C. Valves shall be installed in horizontal piping with stem at or above center of pipe

D. Valves shall be installed in a position to allow full stem movement.

E. Install chain wheels on operators for ball valves NPS 100 mm or DN100 (4 inches) and larger and more than 2400 mm (12 feet) above floor. Chains shall be extended to 1500 mm 3600 mm (60 inches) above finished floor.

F. Check valves shall be installed for proper direction of flow and as follows: 1. Swing Check Valves: In horizontal position with hinge pin level.

3.3 ADJUSTING

A. Valve packing shall be adjusted or replaced after piping systems have been tested and put into service but before final adjusting and balancing. Replace valves shall be replaced if persistent leaking occurs.

- - E N D - - -

SECTION 22 07 11
PLUMBING INSULATION

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Field applied insulation for thermal efficiency and condensation control for
1. Plumbing piping and equipment.
- B. Definitions
1. ASJ: All service jacket, white finish facing or jacket.
 2. Air conditioned space: Space having air temperature and/or humidity controlled by mechanical equipment.
 3. Cold: Equipment or piping handling media at design temperature of 16 degrees C (60 degrees F) or below.
 4. Concealed: Piping above ceilings and in chases, interstitial space, and pipe spaces.
 5. Exposed: Piping and equipment exposed to view in finished areas including mechanical equipment rooms or exposed to outdoor weather. Shafts, chases, interstitial spaces, unfinished attics, crawl spaces and pipe basements are not considered finished areas.
 6. FSK: Foil-scrim-kraft facing.
 7. Hot: Plumbing equipment or piping handling media above 41 degrees C (105 degrees F).
 8. Density: kg/m^3 - kilograms per cubic meter (Pcf - pounds per cubic foot).
 9. Thermal conductance: Heat flow rate through materials.
 - a. Flat surface: Watts per square meter (BTU per hour per square foot).
 - b. Pipe or Cylinder: Watts per square meter (BTU per hour per linear foot).
 10. Thermal Conductivity (k): Watt per meter, per degree C (BTU per inch thickness, per hour, per square foot, per degree F temperature difference).
 11. Vapor Retarder (Vapor Barrier): A material which retards the transmission (migration) of water vapor. Performance of the vapor retarder is rated in terms of permeance (perms). For the purpose of this specification, vapor retarders shall have a maximum published permeance of 0.1 perms and vapor barriers shall have a maximum published permeance of 0.001 perms.

- 12. R: Pump recirculation.
- 13. CW: Cold water.
- 14. SW: Soft water.
- 15. HW: Hot water.
- 16. PVDC: Polyvinylidene chloride vapor retarder jacketing,

white. 1.2 RELATED WORK

- A. Section 07 84 00, FIRESTOPPING: Mineral fiber and bond breaker behind sealant.
- B. Section 22 05 11, COMMON WORK RESULTS FOR PLUMBING: General mechanical requirements and items, which are common to more than one section of Division 22.
- C. Section 22 05 23, GENERAL-DUTY VALVES FOR PLUMBING PIPING: Hot and cold water piping.
- D. Section 26 32 13, ENGINE GENERATORS: Exhaust stacks and muffler.
- E. Section 22 08 00, COMMISSIONING OF PLUMBING SYSTEMS. Requirements for commissioning, systems readiness checklists, and training.

1.3 QUALITY ASSURANCE

- A. Refer to article QUALITY ASSURANCE, in Section 22 05 11, COMMON WORK RESULTS FOR PLUMBING.
- B. Criteria:
 - 1. Comply with NFPA 90A, particularly paragraphs 4.3.3.1 through 4.3.3.6, 4.3.10.2.6, and 5.4.6.4, parts of which are quoted as follows:

4.3.3.1 Pipe insulation and coverings, vapor retarder facings, adhesives, fasteners, tapes, unless otherwise provided for in 4.3.3.1.12 or 4.3.3.1.2, shall have, in the form in which they are used, a maximum flame spread index of 25 without evidence of continued progressive combustion and a maximum smoke developed index of 50 when tested in accordance with NFPA 255, *Standard Method of Test of Surface Burning Characteristics of Building Materials*.

4.3.3.1.1 Where these products are to be applied with adhesives, they shall be tested with such adhesives applied, or the adhesives used shall have a maximum flame spread index of 25 and a maximum smoke developed index of 50 when in the final dry state. (See 4.2.4.2.)

4.3.3.3 Pipe insulation and coverings shall not flame, glow, smolder, or smoke when tested in accordance with a similar test for pipe covering, ASTM C 411, Standard Test Method for Hot-Surface Performance of High-Temperature Thermal Insulation, at the temperature to which they are exposed in service.

4.3.3.3.1 In no case shall the test temperature be below 121°C (250°F).

4.3.10.2.6.3 Nonferrous fire sprinkler piping shall be listed as having a maximum peak optical density of 0.5 or less, an average optical density of 0.15 or less, and a maximum flame spread distance of 1.5 m (5 ft) or less when tested in accordance with UL 1887, Standard for Safety Fire Test of Plastic Sprinkler Pipe for Visible Flame and Smoke Characteristics.

4.3.10.2.6.7 Smoke detectors shall not be required to meet the provisions of this section.

2. Test methods: ASTM E84, UL 723, or NFPA 255.
3. Specified k factors are at 24 degrees C (75 degrees F) mean temperature unless stated otherwise. Where optional thermal insulation material is used, select thickness to provide thermal conductance no greater than that for the specified material. For pipe, use insulation manufacturer's published heat flow tables. For domestic hot water supply and return, run out insulation and condensation control insulation, no thickness adjustment need be made.
4. All materials shall be compatible and suitable for service temperature, and shall not contribute to corrosion or otherwise attack surface to which applied in either the wet or dry state.

C. Every package or standard container of insulation or accessories delivered to the job site for use must have a manufacturer's stamp or label giving the name of the manufacturer and description of the material.

1.4 SUBMITTALS

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Shop Drawings:
 1. All information, clearly presented, shall be included to determine compliance with drawings and specifications and ASTM, federal and military specifications.
 - a. Insulation materials: Specify each type used and state surface burning characteristics.
 - b. Insulation facings and jackets: Each type used.
 - c. Insulation accessory materials: Each type used.
 - d. Manufacturer's installation and fitting fabrication instructions for flexible unicellular insulation.
 - e. Make reference to applicable specification paragraph numbers for coordination.

1.5 STORAGE AND HANDLING OF MATERIAL

Store materials in clean and dry environment, pipe covering jackets shall be clean and unmarred. Place adhesives in original containers. Maintain ambient temperatures and conditions as required by printed instructions of manufacturers of adhesives, mastics and finishing cements.

1.6 APPLICABLE PUBLICATIONS

- A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by basic designation only.
- B. Federal Specifications (Fed. Spec.):
- L-P-535E (2)-91 Plastic Sheet (Sheeting): Plastic Strip; Poly (Vinyl Chloride) and Poly (Vinyl Chloride - Vinyl Acetate), Rigid.
- C. Military Specifications (Mil. Spec.):
- MIL-A-3316C (2)-90Adhesives, Fire-Resistant, Thermal Insulation
- MIL-A-24179A (1)-87Adhesive, Flexible Unicellular-Plastic Thermal Insulation
- MIL-C-19565C (1)-88Coating Compounds, Thermal Insulation, Fire-and Water-Resistant, Vapor-Barrier
- MIL-C-20079H-87 Cloth, Glass; Tape, Textile Glass; and Thread, Glass and Wire-Reinforced Glass
- D. American Society for Testing and Materials (ASTM):
- A167-04Standard Specification for Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip
- B209-07 Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate
- C411-05Standard test method for Hot-Surface Performance of High-Temperature Thermal Insulation
- C449-07 Standard Specification for Mineral Fiber Hydraulic-Setting Thermal Insulating and Finishing Cement
- C533-09Standard Specification for Calcium Silicate Block and Pipe Thermal Insulation

- C534-08 Standard Specification for Preformed Flexible Elastomeric Cellular Thermal Insulation in Sheet and Tubular Form
- C547-07 Standard Specification for Mineral Fiber pipe Insulation
- C552-07 Standard Specification for Cellular Glass Thermal Insulation
- C553-08 Standard Specification for Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications
- C585-09 Standard Practice for Inner and Outer Diameters of Rigid Thermal Insulation for Nominal Sizes of Pipe and Tubing (NPS System) R (1998)
- C612-10 Standard Specification for Mineral Fiber Block and Board Thermal Insulation
- C1126-10 Standard Specification for Faced or Unfaced Rigid Cellular Phenolic Thermal Insulation
- C1136-10 Standard Specification for Flexible, Low Permeance Vapor Retarders for Thermal Insulation
- D1668-97a (2006) Standard Specification for Glass Fabrics (Woven and Treated) for Roofing and Waterproofing
- E84-10 Standard Test Method for Surface Burning Characteristics of Building Materials
- E119-09C Standard Test Method for Fire Tests of Building Construction and Materials
- E136-09 b Standard Test Methods for Behavior of Materials in a Vertical Tube Furnace at 750 degrees C (1380 F)
- E. National Fire Protection Association (NFPA):
- 101-09 Life Safety Code
- 251-06 Standard methods of Tests of Fire Endurance of Building Construction Materials
- 255-06 Standard Method of tests of Surface Burning Characteristics of Building Materials

- F. Underwriters Laboratories, Inc (UL):
 723 UL Standard for Safety Test for Surface Burning
 Characteristics of Building Materials with
 Revision of 08/03
- G. Manufacturer's Standardization Society of the Valve and
 Fitting Industry (MSS):
 SP58-2002 Pipe Hangers and Supports Materials, Design,
 and Manufacture

PART 2 - PRODUCTS

2.1 MINERAL FIBER OR FIBER GLASS

- A. ASTM C612 (Board, Block), Class 1 or 2, density 48 kg/m³ (3 pcf), k = 0.037 (.26) at 24 degrees C (75 degrees F), external insulation for temperatures up to 204 degrees C (400 degrees F).
- B. ASTM C553 (Blanket, Flexible) Type I, // Class B-3, Density 16 kg/m³ (1 pcf), k = 0.045 (0.31) // Class B-5, Density 32 kg/m³ (2 pcf), k = 0.04 (0.27) // at 24 degrees C (75 degrees F), for use at temperatures up to 204 degrees C (400 degrees F)
- C. ASTM C547 (Pipe Fitting Insulation and Preformed Pipe Insulation), Class 1, k = 0.037 (0.26) at 24 degrees C (75 degrees F), for use at temperatures up to 230 degrees C (450 degrees F) with an all service vapor retarder jacket with polyvinyl chloride premolded fitting covering.

2.2 Mineral wool or refractory fiber

- A. Comply with Standard ASTM C612, Class 3, 450 degrees C (850 degrees

F). 2.3 RIGID CELLULAR PHENOLIC FOAM

- A. Preformed (molded) pipe insulation, ASTM C1126, type III, grade 1, k = 0.021(0.15) at 10 degrees C (50 degrees F), for use at temperatures up to 121 degrees C (250 degrees F) with vapor retarder and all service vapor retarder jacket with polyvinyl chloride premolded fitting covering.
- B. Equipment Insulation, ASTM C 1126, type II, grade 1, k = 0.021 (0.15) at 10 degrees C (50 degrees F), for use at temperatures up to 121 degrees C (250 degrees F) with rigid cellular phenolic insulation and covering, and all service vapor retarder jacket.

2.4 CELLULAR GLASS CLOSED-CELL

- A. Comply with Standard ASTM C177, C518, density 120 kg/m³ (7.5 pcf) nominal, k = 0.033 (0.29) at 240 degrees C (75 degrees F).

- B. Pipe insulation for use at temperatures up to 200 degrees C (400 degrees F) with all service vapor retarder jacket.

Insulation Characteristics		
ITEMS	TYPE I	TYPE II
Temperature, maximum degrees C (degrees F)	649 (1200)	927 (1700)
Density (dry), Kg/m ³ (lb/ ft ³)	232 (14.5)	288 (18)
Thermal conductivity: Min W/ m K (Btu in/h ft ² degrees F)@ mean temperature of 93 degrees C (200 degrees F)	0.059 (0.41)	0.078 (0.540)
Surface burning characteristics: Flame spread Index, Maximum	0	0
Smoke Density index, Maximum	0	0

2.5 INSULATION FACINGS AND JACKETS

- A. Vapor Retarder, higher strength with low water permeance = 0.02 or less perm rating, Beach puncture 50 units for insulation facing on pipe insulation jackets. Facings and jackets shall be all service type (ASJ) or PVDC Vapor Retarder jacketing.
- B. ASJ jacket shall be white kraft bonded to 0.025 mm (1 mil) thick aluminum foil, fiberglass reinforced, with pressure sensitive adhesive closure. Comply with ASTM C1136. Beach puncture 50 units, Suitable for painting without sizing. Jackets shall have minimum 40 mm (1-1/2 inch) lap on longitudinal joints and minimum 75mm (3 inch) butt strip on end joints. Butt strip material shall be same as the jacket. Lap and butt strips shall be self-sealing type with factory-applied pressure sensitive adhesive.
- C. Vapor Retarder medium strength with low water vapor permeance of 0.02 or less perm rating), Beach puncture 25 units: Foil-Scrim-Kraft (FSK) or PVDC vapor retarder jacketing type for concealed ductwork and equipment.

- D. Field applied vapor barrier jackets shall be provided, in addition to the specified facings and jackets, on all exterior piping as well as on interior piping exposed to outdoor air (i.e.; in ventilated attics, piping in ventilated (not air conditioned) spaces, etc.) in high humidity areas conveying fluids below ambient temperature. The vapor barrier jacket shall consist of a multi-layer laminated cladding with a maximum water vapor permeance of 0.001 perms. The minimum puncture resistance shall be 35 cm-kg (30 inch-pounds) for interior locations and 92 cm-kg (80 inch-pounds) for exterior or exposed locations or where the insulation is subject to damage.
- E. Glass Cloth Jackets: Presized, minimum 0.18 kg per square meter (7.8 ounces per square yard), 2000 kPa (300 psig) bursting strength with integral vapor retarder where required or specified. Weather proof if utilized for outside service.
- F. Factory composite materials may be used provided
- G. Pipe fitting insulation covering (jackets): Fitting covering shall be premolded to match shape of fitting and shall be polyvinyl chloride (PVC) conforming to Fed Spec L-P-335, composition A, Type II Grade GU, and Type III, minimum thickness 0.7 mm (0.03 inches). Provide color matching vapor retarder pressure sensitive tape.
- H. Aluminum Jacket-Piping systems and circular breeching and stacks: ASTM B209, 3003 alloy, H-14 temper, 0.6 mm (0.023 inch) minimum thickness with locking longitudinal joints. Jackets for elbows, tees and other fittings shall be factory-fabricated to match shape of fitting and of 0.6 mm (0.024) inch minimum thickness aluminum. Fittings shall be of same construction as straight run jackets but need not be of the same alloy. Factory-fabricated stainless steel bands shall be installed on all circumferential joints. Bands shall be 13 mm (0.5 inch) wide on 450 mm (18 inch) centers. System shall be weatherproof if utilized for outside service.
- I. Aluminum jacket-Rectangular breeching: ASTM B209, 3003 alloy, H-14 temper, 0.5 mm (0.020 inches) thick with 32 mm (1-1/4 inch) corrugations or 0.8 mm (0.032 inches) thick with no corrugations. System shall be weatherproof if used for outside service.

2.6 PIPE COVERING PROTECTION SADDLES

- A. Cold pipe support: Premolded pipe insulation 180 degrees (half-shells) on bottom half of pipe at supports. Material shall be cellular glass or high density Polyisocyanurate insulation of the same thickness as adjacent insulation. Density of Polyisocyanurate insulation shall be a minimum of 48 kg/m³ (3.0 pcf).

Nominal Pipe Size and Accessories Material (Insert Blocks)	
Nominal Pipe Size mm (inches)	Insert Blocks mm (inches)
Up through 125 (5)	150 (6) long
150 (6)	150 (6) long
200 (8), 250 (10), 300 (12)	225 (9) long
350 (14), 400 (16)	300 (12) long
450 through 600 (18 through 24)	350 (14) long

- B. Warm or hot pipe supports: Premolded pipe insulation (180 degree half-shells) on bottom half of pipe at supports. Material shall be high density Polyisocyanurate (for temperatures up to 149 degrees C [300 degrees F]), cellular glass or calcium silicate. Insulation at supports shall have same thickness as adjacent insulation. Density of Polyisocyanurate insulation shall be a minimum of 48 kg/m³ (3.0 pcf).

2.7 ADHESIVE, MASTIC, CEMENT

- A. Mil. Spec. MIL-A-3316, Class 1: Jacket and lap adhesive and protective finish coating for insulation.
- B. Mil. Spec. MIL-A-3316, Class 2: Adhesive for laps and for adhering insulation to metal surfaces.
- C. Mil. Spec. MIL-A-24179, Type II Class 1: Adhesive for installing flexible unicellular insulation and for laps and general use.
- D. Mil. Spec. MIL-C-19565, Type I: Protective finish for outdoor use.
- E. Mil. Spec. MIL-C-19565, Type I or Type II: Vapor barrier compound for indoor use.
- F. ASTM C449: Mineral fiber hydraulic-setting thermal insulating and finishing cement.
- G. Other: Insulation manufacturers' published recommendations.

2.8 MECHANICAL FASTENERS

- A. Pins, anchors: Welded pins, or metal or nylon anchors with galvanized steel or fiber washer, or clips. Pin diameter shall be as recommended by the insulation manufacturer.

- B. Staples: Outward clinching galvanized steel
- C. Wire: 1.3 mm thick (18 gage) soft annealed galvanized or 1.9 mm (14 gage) copper clad steel or nickel copper alloy.
- D. Bands: 13 mm (1/2 inch) nominal width, brass, galvanized steel, aluminum or stainless steel.

2.9 REINFORCEMENT AND FINISHES

- A. Glass fabric, open weave: ASTM D1668, Type III (resin treated) and Type I (asphalt treated).
- B. Glass fiber fitting tape: Mil. Spec MIL-C-20079, Type II, Class 1.
- C. Tape for Flexible Elastomeric Cellular Insulation: As recommended by the insulation manufacturer.
- D. Hexagonal wire netting: 25 mm (one inch) mesh, 0.85 mm thick (22 gage) galvanized steel.
- E. Corner beads: 50 mm (2 inch) by 50 mm (2 inch), 0.55 mm thick (26 gage) galvanized steel; or, 25 mm (1 inch) by 25 mm (1 inch), 0.47 mm thick (28 gage) aluminum angle adhered to 50 mm (2 inch) by 50 mm (2 inch) Kraft paper.
- F. PVC fitting cover: Fed. Spec L-P-535, Composition A, 11-86 Type II, Grade GU, with Form B Mineral Fiber insert, for media temperature 4 degrees C (40 degrees F) to 121 degrees C (250 degrees F). Below 4 degrees C (40 degrees F) and above 121 degrees C (250 degrees F). Provide double layer insert. Provide color matching vapor barrier pressure sensitive tape.

2.10 FIRESTOPPING MATERIAL

Other than pipe insulation, refer to Section 07 84 00

FIRESTOPPING. 2.11 FLAME AND SMOKE

Unless shown otherwise all assembled systems shall meet flame spread 25 and smoke developed 50 rating as developed under ASTM, NFPA and UL standards and specifications. See paragraph 1.3 "Quality Assurance".

PART 3 - EXECUTION

3.1 GENERAL REQUIREMENTS

- A. Required pressure tests of piping joints and connections shall be completed and the work approved by the COTR for application of insulation. Surface shall be clean and dry with all foreign materials, such as dirt, oil, loose scale and rust removed.

- B. Except for specific exceptions, insulate all specified equipment, and piping (pipe, fittings, valves, accessories). Insulate each pipe individually. Do not use scrap pieces of insulation where a full length section will fit.
- C. Insulation materials shall be installed in a first class manner with smooth and even surfaces, with jackets and facings drawn tight and smoothly cemented down at all laps. Insulation shall be continuous through all sleeves and openings, except at fire dampers and duct heaters (NFPA 90A). Vapor retarders shall be continuous and uninterrupted throughout systems with operating temperature 16 degrees C (60 degrees F) and below. Lap and seal vapor barrier over ends and exposed edges of insulation. Anchors, supports and other metal projections through insulation on cold surfaces shall be insulated and vapor sealed for a minimum length of 150 mm (6 inches).
- D. Install vapor stops at all insulation terminations on either side of valves, pumps and equipment and particularly in straight lengths of pipe insulation.
- E. Construct insulation on parts of equipment such as cold water pumps and heat exchangers that must be opened periodically for maintenance or repair, so insulation can be removed and replaced without damage. Install insulation with bolted 1 mm thick (20 gage) galvanized steel or aluminum covers as complete units, or in sections, with all necessary supports, and split to coincide with flange/split of the equipment.
- F. Insulation on hot piping and equipment shall be terminated square at items not to be insulated, access openings and nameplates. Cover all exposed raw insulation with white sealer or jacket material.
- G. Protect all insulations outside of buildings with aluminum jacket using lock joint or other approved system for a continuous weather tight system. Access doors and other items requiring maintenance or access shall be removable and sealable.
- H. Plumbing work not to be insulated:
 - 1. Piping and valves of fire protection system.
 - 2. Chromium plated brass piping.
 - 3. Water piping in contact with earth.
 - 4. Small horizontal cold water branch runs in partitions to individual fixtures may be without insulation for maximum distance of 900 mm (3 feet).
 - 5. Distilled water piping.

- I. Apply insulation materials subject to the manufacturer's recommended temperature limits. Apply adhesives, mastic and coatings at the manufacturer's recommended minimum coverage.
- J. Elbows, flanges and other fittings shall be insulated with the same material as is used on the pipe straights.
Use of polyurethane spray-foam to fill a PVC elbow jacket is prohibited on cold applications.
- K. Firestop Pipe insulation:
1. Provide firestopping insulation at fire and smoke barriers through penetrations. Fire stopping insulation shall be UL listed as defines in Section 07 84 00, FIRESTOPPING.
 2. Pipe penetrations requiring fire stop insulation including, but not limited to the following:
 - a. Pipe risers through floors
 - b. Pipe chase walls and floors
 - c. Smoke partitions
 - d. Fire partitions
- L. Freeze protection of above grade outdoor piping (over heat tracing tape): 20 mm (0.75) thick insulation, for all pipe sizes 75 mm(3 inches) and smaller and 25 mm(1inch) thick insulation for larger pipes. Provide metal jackets for all pipes. Provide for cold water make-up where indicated on the drawings as described in Section 23 21 13, HYDRONIC PIPING (electrical heat tracing systems).
- M. Provide vapor barrier jackets over insulation as follows:
1. All piping exposed to outdoor weather.
 2. All interior piping conveying fluids (i.e. in attics, ventilated (not air conditioned) spaces, etc.).
- N. Provide metal jackets over insulation as follows:
- a. All plumbing piping exposed to outdoor weather.
 - b. Piping exposed in building, within 1800 mm (6 feet) of the floor, that connects to sterilizers, kitchen and laundry equipment. Jackets may be applied with pop rivets. Provide aluminum angle ring escutcheons at wall, ceiling or floor penetrations.
 - c. A 50 mm (2 inch) overlap is required at longitudinal and circumferential joints.

3.2 INSULATION INSTALLATION

A. Mineral Fiber Board:

1. Faced board: Apply board on pins spaced not more than 300 mm (12 inches) on center each way, and not less than 75 mm (3 inches) from each edge of board. In addition to pins, apply insulation bonding adhesive to entire underside of horizontal metal surfaces. Butt insulation edges tightly and seal all joints with laps and butt strips. After applying speed clips cut pins off flush and apply vapor seal patches over clips.
2. Plain board:
 - a. Insulation shall be scored, beveled or mitered to provide tight joints and be secured to equipment with bands spaced 225 mm (9 inches) on center for irregular surfaces or with pins and clips on flat surfaces. Use corner beads to protect edges of insulation.
 - b. For hot equipment: Stretch 25 mm (1 inch) mesh wire, with edges wire laced together, over insulation and finish with insulating and finishing cement applied in one coat, 6 mm (1/4 inch) thick, trowel led to a smooth finish.
 - c. For cold equipment: Apply meshed glass fabric in a tack coat 1.5 to 1.7 square meter per liter (60 to 70 square feet per gallon) of vapor mastic and finish with mastic at 0.3 to 0.4 square meter per liter (12 to 15 square feet per gallon) over the entire fabric surface.
3. Cold equipment: 40 mm (1-1/2 inch) thick insulation faced with ASJ.
 - a. Water filter, chemical feeder pot or tank.
 - b. Pneumatic, cold storage water and surge tanks.
4. Hot equipment: 40 mm (1-1/2 inch) thick insulation faced with ASJ.
 - a. Domestic water heaters and hot water storage tanks (not factory insulated).
 - b. Booster water heaters for dietetics dish and pot washers and for washdown grease-extracting hoods.

B. Molded Mineral Fiber Pipe and Tubing Covering:

1. Fit insulation to pipe, aligning longitudinal joints. Seal longitudinal joint laps and circumferential butt strips by rubbing hard with a nylon sealing tool to assure a positive seal. Staples may be used to assist in securing insulation. Seal all vapor retarder penetrations on cold piping with a generous application of

- vapor barrier mastic. Provide inserts and install with metal insulation shields at outside pipe supports. Install freeze protection insulation over heating cable.
2. Contractor's options for fitting, flange and valve insulation:
 - a. Insulating and finishing cement for sizes less than 100 mm (4 inches) operating at surface temperature of 16 degrees C (61 degrees F) or more.
 - b. Factory premolded, one piece PVC covers with mineral fiber, (Form B), inserts. Provide two insert layers for pipe temperatures below 4 degrees C (40 degrees F), or above 121 degrees C (250 degrees F). Secure first layer of insulation with twine. Seal seam edges with vapor barrier mastic and secure with fitting tape.
 - c. Factory molded, ASTM C547 or field mitered sections, joined with adhesive or wired in place. For hot piping finish with a smoothing coat of finishing cement. For cold fittings, 16 degrees C (60 degrees F) or less, vapor seal with a layer of glass fitting tape imbedded between two 2 mm (1/16 inch) coats of vapor barrier mastic.
 - d. Fitting tape shall extend over the adjacent pipe insulation and overlap on itself at least 50 mm (2 inches).
 3. Nominal thickness in millimeters and inches specified in the schedule at the end of this section.
 4. Note the NFPA 90A burning characteristics requirements of 25/50 in paragraph 1.3.B
 5. Provide secure attachment facilities such as welding pins.
 6. Apply insulation with joints tightly drawn together
 7. Apply adhesives, coverings, neatly finished at fittings, and valves.
 8. Final installation shall be smooth, tight, neatly finished at all edges.
 9. Minimum thickness in millimeters (inches) specified in the schedule at the end of this section.
 10. Condensation control insulation: Minimum 25 mm (1.0 inch) thick for all pipe sizes.
 - a. Plumbing piping as follows:
 - 1) Body of roof and overflow drains horizontal runs and offsets (including elbows) of interior downspout piping in all areas above pipe basement.

- 2) Waste piping from electric water coolers and icemakers to drainage system.
- 3) Waste piping located above basement floor from ice making and film developing equipment and air handling units, from equipment(including trap) to main vertical waste pipe.
- 4) MRI quench vent piping.
- 5) Bedpan sanitizer atmospheric vent
- 6) Reagent grade water piping.
- 7) Cold water piping.

D. Cellular Glass Insulation:

1. Pipe and tubing, covering nominal thickness in millimeters and inches as specified in the schedule at the end of this section.
2. Underground Piping Other than or in lieu of that Specified in Section 22 11 00, FACILITY WATER DISTRIBUTION: Type II, factory jacketed with a 3 mm laminate jacketing consisting of 3000 mm x 3000 mm (10 ft x 10 ft) asphalt impregant⁴ed glass fabric, bituminous mastic and outside protective plastic film.
 - a. 75 mm (3 inches) thick for hot water piping.
 - b. As scheduled at the end of this section for chilled water piping.
 - c. Underground piping: Apply insulation with joints tightly butted. Seal longitudinal self-sealing lap. Use field fabricated or factory made fittings. Seal butt joints and fitting with jacketing as recommended by the insulation manufacturer. Use 100 mm (4 inch) wide strips to seal butt joints.
 - d. Provide expansion chambers for pipe loops, anchors and wall penetrations as recommended by the insulation manufacturer.
 - e. Underground insulation shall be inspected and approved by the COTR as follows:
 - 1) Insulation in place before coating.
 - 2) After coating.
 - f. Sand bed and backfill: Minimum 75 mm (3 inches) all around Insulated pipe or tank, applied after coating has dried.
3. Cold equipment: 50 mm (2 inch) thick insulation faced with ASJ.
4. Install insulation, vapor retarder and jacketing per manufacturer's recommendations. Particular attention should be paid to recommendations for joint staggering, adhesive application, external hanger design, expansion/contraction joint design and spacing and vapor retarder integrity.

5. Install insulation with all joints tightly butted (except expansion) joints in hot applications).
6. If insulation thickness exceeds 63 mm (2.5 inches), install as a double layer system with longitudinal (lap) and butt joint staggering as recommended by manufacturer.
7. For cold applications, vapor retarder shall be installed in a continuous manner. No staples, rivets, screws or any other attachment device capable of penetrating the vapor retarder shall be used to attach the vapor retarder or jacketing. No wire ties capable of penetrating the vapor retarder shall be used to hold the insulation in place. Banding shall be used to attach PVC or metal jacketing.
8. Elbows, flanges and other fittings shall be insulated with the same material as is used on the pipe straights. The elbow/ fitting insulation shall be field-fabricated, mitered or factory prefabricated to the necessary size and shape to fit on the elbow/ fitting. Use of polyurethane spray-foam to fill PVC elbow jacket is prohibited on cold applications.
9. For cold applications, the vapor retarder on elbows/fittings shall be either mastic-fabric-mastic or 2 mil thick PVDC vapor retarder adhesive tape.
10. All PVC and metal jacketing shall be installed so as to naturally shed water. Joints shall point down and shall be sealed with either adhesive or caulking (except for periodic slip joints).
11. Note the NFPA 90A burning characteristic requirements of 25/50 in paragraph 1.3B. Refer to paragraph 3.1 for items not to be insulated.
12. Minimum thickness in millimeter (inches) specified in the schedule at the end of this section.
13. Apply sheet insulation to flat or large curved surfaces with 100 percent adhesive coverage. For fittings and large pipe, apply adhesive to seams only.
14. Pipe insulation: nominal thickness in millimeters (inches as specified in the schedule at the end of this section.

3.4 PIPE INSULATION SCHEDULE

Provide insulation for piping systems as scheduled below:

Insulation Thickness Millimeters (Inches)					
Operating Temperature Range/Service	Insulation Material	Nominal Pipe Size Millimeters (Inches)			
		Less than	25 - 32 (1 - 1 1/4)	38 - 75 (1 1/2 - 3)	100 (4) and Above
38-60 degrees C (100-140 degrees F) (Domestic Hot Water Supply and Return)	Mineral Fiber (Above ground piping only)	38 (1.5)	38 (1.5)	50 (2.0)	50 (2.0)
38-60 degrees C (100-140 degrees F) (Domestic Hot Water Supply and Return)	Rigid Cellular Phenolic Foam (Above ground piping only)	38 (1.5)	38 (1.5)	50 (2.0)	50 (2.0)
38-60 degrees C (100-140 degrees F) (Domestic Hot Water Supply and Return)		38 (1.5)	38 (1.5)	----	----
38-60 degrees C (100-140 degrees F) (Domestic Hot Water Supply and Return)	Flexible Elastomeric Cellular Thermal (Above ground piping only)	38 (1.5)	38 (1.5)	----	----
4-16 degrees C (40-60 degrees F) (// Ice water piping //)	Rigid Cellular Phenolic Foam (Above ground piping only)	25 (1.0)	25(1.0)	25 (1.0)	25 (1.0)
4-16 degrees C (40-60 degrees F) (// Ice water piping //)		25 (1.0)	25(1.0)	25 (1.0)	25 (1.0)
(4-16 degrees C (40-60 degrees F) (// Ice water piping //))	Flexible Elastomeric Cellular Thermal (Above ground piping only)	25 (1.0)	25(1.0)	25 (1.0)	25 (1.0)

- - - E N D - - -

THIS PAGE INTENTIONALLY LEFT BLANK

SECTION 22 11 00
FACILITY WATER DISTRIBUTION

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Domestic water systems, including piping, equipment and all necessary accessories as designated in this section.

1.2 RELATED WORK

- A. Section 07 84 00, FIRESTOPPING: Penetrations in rated enclosures
- B. Section 09 91 00, PAINTING: Preparation and finish painting and identification of piping systems.
- C. Section 22 05 11, COMMON WORK RESULTS FOR PLUMBING.
- D. Section 23 07 11, HVAC, PLUMBING, AND BOILER PLANT INSULATION, PIPE INSULATION.

1.3 SUBMITTALS

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Manufacturer's Literature and Data:
 - 1. All items listed in Part 2 - Products.

1.4 APPLICABLE PUBLICATIONS

- A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.
- B. American National Standards Institute (ANSI):
 - American Society of Mechanical Engineers (ASME): (Copyrighted Society)
 - A13.1-2007Scheme for Identification of Piping Systems
 - B16.3-2006Malleable Iron Threaded Fittings Classes 150 and 300
 - B16.9-2007 Gray Iron Threaded Fittings Classes 125 and 250
 - B16.9-2007Factory-Made Wrought Butt Welding Fittings ANSI/ASME
 - B16.11-2009 Forged Fittings, Socket-Welding and Threaded ANSI/ASME
 - B16.12-2009Cast Iron Threaded Drainage Fittings ANSI/ASME
 - B16.15-2006Cast Bronze Threaded Fittings Classes 125 and 250 ANSI/ASME
 - B16.18-01 (R2005)Cast Copper Alloy Solder-Joint Pressure Fittings ANSI/ASME

B16.22-01 (R2005) Wrought Copper and Copper Alloy Solder Joint
 Pressure Fittings ANSI/ASME Element ANSI/ASME
 NSF/ANSI 61 Drinking Water System Components - Health
 Effects

C. American Society for Testing and Materials (ASTM):

A47/A47M-99(2009) Ferritic Malleable Iron Castings Revision 1989
 A53/A53M-07 Pipe, Steel, Black And Hot-Dipped, Zinc-coated
 Welded and Seamless
 A183-03(2009) Carbon Steel Track Bolts and Nuts
 A269-10 Standard Specification for Seamless and Welded
 Austenitic Stainless Steel Tubing for General
 Service
 A312/A312M-09 Seamless, Welded, and Heavily Cold Worked
 Austenitic Stainless Steel Pipes
 A403/A403M-10a Standard Specification for Wrought Austenitic
 Stainless Steel Piping Fittings
 A536-84(2009) Ductile Iron Castings
 A733-03(2009) Welded and Seamless Carbon Steel and Austenitic
 Stainless Steel Pipe Nipples
 B32-08 Solder Metal
 B61-08 Steam or Bronze Castings
 B62-09 Composition Bronze or Ounce Metal Castings
 B75-02 Seamless Copper Tube
 B88-09 Seamless Copper Water Tube
 B300-10 AWWA Standard for Hypochlorites
 B301-10 AWWA Standard for Liquid Chlorine
 B584-09a Copper Alloy Sand Castings for General
 Applications Revision A
 B687-99(2005) e1 Brass, Copper, and Chromium-Plated Pipe Nipples
 D1785-06 Standard Specification for Poly (Vinyl
 Chloride) (PVC) Plastic Pipe, Schedules 40,
 80, and 120
 D2000-08 Rubber Products in Automotive Applications
 D4101-09 Propylene Plastic Injection and Extrusion
 Materials
 D2447-03 Polyethylene (PE) Plastic Pipe, Schedule 40 and
 80, Based on Outside Diameter

- D2564-04(2009) e1 Solvent Cements for Poly (Vinyl Chloride) (PVC)
Plastic Pipe and Fittings
- D4101-09 Propylene Plastic Injection and Extrusion
Materials
- E1120-08 Standard Specification For Liquid Chlorine
- E1229-08 Standard Specification For Calcium Hypochlorite
- D. American Water Works Association (AWWA):
- C110-08 Ductile Iron and Gray Iron Fittings - 75 mm
thru 1200 mm (3 inch thru 48 inches) for Water
and other liquids AWWA/ANSI
- C151/A21.51-09 Ductile-Iron Pipe, Centrifugally Cast in Metal
Molds or Sand-Lined Molds, for Water or Other
Liquids AWWA/ ANSI
- C153/A21.53-06 AWWA Standard for Ductile-Iron Compact Fittings
for Water Service AWWA/ANSI
- C203-08 Coal-Tar Protective Coatings and Linings for
Steel Water Pipelines - Enamel and Tape - Hot
Applied AWWA/ANSI
- C213-07 Fusion Bonded Epoxy Coating For The Interior &
Exterior Of Steel Water Pipelines
- C651-05 Disinfecting Water Mains
- E. American Welding Society (AWS):
- A5.8/A5.8M:2004 Filler Metals for Brazing
- F. International Plumbing Code
International Plumbing Code - 2009
- G. American Society of Sanitary Engineers
(ASSE): ANSI/ASSE (Plumbing)
- 1001-2008 Pipe Applied Atmospheric Type Vacuum Breakers
- ANSI/ASSE 1010-2004 ... Water Hammer Arresters
- ANSI/ASSE 1018-2001 ... Performance for trap seal primer valves -
potable water supplied.
- ANSI/ASSE (Plumbing)
- 1020-2004 Pressure Vacuum Breaker Assembly
- H. Plumbing and Drainage Institute (PDI):
- PDI WH-201 2007 Water Hammer Arrestor

1.5 QUALITY ASSURANCE

- A. Submit prior to welding of steel piping a certificate of Welder's certification. The certificate shall be current and more than one year old.
- B. For mechanical pressed sealed fittings, only tools of fitting manufacture shall be used.
- C. Mechanical pressed fittings shall be installed by factory trained workers.
- D. All grooved joint couplings, fittings, valves, and specialties shall be the products of a single manufacturer. Grooving tools shall be by the same manufacturer as the groove components.
- E. All castings used for coupling housings, fittings, valve bodies, etc., shall be date stamped for quality assurance and traceability.

1.6 SPARE PARTS

- A. For mechanical pressed sealed fittings provide tools required for each pipe size used at the facility.

PART 2 - PRODUCTS

2.1 UNDERGROUND WATER SERVICE CONNECTIONS TO BUILDINGS

- A. From inside face of exterior wall to a distance of approximately 1500 mm (5 feet) outside of building and underground inside building, material selected shall be the same for the size specified.
- B. Seventy five millimeters (3 inch) Diameter and Over: Ductile iron, AWWA C151, 850 kPa (125 psi) water steam pressure (WSP), exterior bituminous coating, and cement lined. Provide flanged and anchored connection to interior piping.
- C. Under 75 mm (3 inch) Diameter: Copper tubing, ASTM B88, Type K, seamless, annealed. Fittings as specified under Article 2.2, INTERIOR DOMESTIC WATER PIPING. Use brazing alloys, AWS A5.8, Classification BCuP.

2.2 ABOVE GROUND (INTERIOR) WATER PIPING

- A. Pipe: Copper tube, ASTM B88, Type K or L, drawn. For pipe 150 mm (6 inches) and larger, stainless, steel ASTM A312, schedule 10 may be used.
- B. Fittings for Copper Tube:
 - 1. Wrought copper or bronze castings conforming to ANSI B16.18 and B16.22. Unions shall be bronze, MSS SP72 & SP 110, Solder or braze joints. Use 95/5 tin and antimony for all soldered joints.

2. Grooved fittings, 50 to 150 mm (2 to 6 inch) wrought copper ASTM B75 C12200, 125 to 150 mm (5 to 6 inch) bronze casting ASTM B584, CDA 844. Mechanical grooved couplings, ductile iron, ASTM A536 (Grade 65-45-12), or malleable iron, ASTM A47 (Grade 32510) housing, with EPDM gasket, steel track head bolts, ASTM A183, coated with copper colored alkyd enamel.
3. Mechanical press sealed fittings, 65 mm (2-1/2") in size and smaller. Fittings shall be double pressed type NSF/ANSI 61 approved and utilize EPDM (Ethylene Propylene Diene Monomer) non toxic synthetic rubber sealing elements.
4. Mechanically formed tee connection: Form mechanically extracted collars in a continuous operation by drilling pilot hole and drawing out tube surface to form collar, having a height of not less than three times the thickness of tube wall. Adjustable collaring device shall insure proper tolerance and complete uniformity of the joint. Notch and dimple joining branch tube in a single process to provide free flow where the branch tube penetrates the fitting. Braze joints.

C. Fittings for Stainless Steel:

1. Stainless steel butt-welded fittings, Type 316, Schedule 10, conforming to ANSI B16.9.
2. Grooved fittings, stainless steel, Type 316, Schedule 10, conforming to ASTM A403. Segmentally fabricated fittings are not allowed. Mechanical grooved couplings, ductile iron, ASTM A536 (Grade 65-45-12), or Malleable iron, ASTM A47 (Grade 32510) housing, with EPDM gasket, steel track head bolts, ASTM A183, coated with copper colored alkyd enamel.

D. Adapters: Provide adapters for joining screwed pipe to copper tubing.

E. Solder: ASTM B32 Composition Sb5 HA or HB. Provide non-corrosive flux.

F. Brazing alloy: AWS A5.8, Classification BCuP.

G. Reagent Grade Water Piping and Dialysis Water Piping:

1. Polypropylene, ASTM D4101, Schedule 80 pressure pipe with dimensions in conformance with ASTM D2447, but without additions of modifiers, plasticizers, colorants, stabilizers or lubricants. This virgin un-plasticized pipe and fittings shall transport 10 megohm water with no loss of purity. Provide socket fusion joints.

2. Polyethylene, food and medical grade, capable of transporting 10 megohm water with no loss of purity. Processed by continuous compression molding without the addition of fillers, polymer modifiers or processing aids. Uniform color with no cracks, flaws, blisters or other imperfections in appearance. Provide heat fusion butt welded joints. In accordance with manufacturer's recommendations, provide continuous channel support under all horizontal piping.
3. Reverse Osmosis (RO) Water Piping:
 - a. Low Pressure Feed, Reject and Recycle Piping (75 psi and under): ASTM D 1785, Schedule 80 PVC, socket welded and flanged.
 - b. RO Product Tubing From Each Membrane Housing: ASTM D1785, Schedule 80 PVC, socket welded and flanged.
 - c. Low Pressure Control and Pressure Gage Tubing: Polyethylene.
 - d. High Pressure Reject and Recycle Piping (above 75 psi): ASTM A269, Type 304 schedule 10 stainless steel with butt welded joints.
 - e. High Pressure Control and Pressure Gage Tubing: 1000 psi burst nylon.

2.3 EXPOSED WATER PIPING

- A. Finished Room: Use full iron pipe size chrome plated brass piping for exposed water piping connecting fixtures, casework, cabinets, equipment and reagent racks when not concealed by apron including those furnished by the Government or specified in other sections.
 1. Pipe: Fed. Spec. WW-P-351, standard weight.
 2. Fittings: ANSI B16.15 cast bronze threaded fittings with chrome finish, (125 and 250).
 3. Nipples: ASTM B 687, Chromium-plated.
 4. Unions: Mss SP-72, SP-110, Brass or Bronze with chrome finish. Unions 65 mm (2-1/2 inches) and larger shall be flange type with approved gaskets.
- B. Unfinished Rooms, Mechanical Rooms and Kitchens: Chrome-plated brass piping is not required. Paint piping systems as specified in Section 09 91 00, PAINTING.

2.4 ETO (ETHYLENE OXIDE) STERILIZER WATER SUPPLY PIPING

- A. Stainless steel, ASTM A312, Schedule 10 with stainless steel butt welded fittings. Provide on sterilizer water supply.

2.5 TRAP PRIMER WATER PIPING:

- A. Pipe: Copper tube, ASTM B88, type K, hard drawn.
- B. Fittings: Bronze castings conforming to ANSI B16.18 Solder joints.
- C. Solder: ASTM B32 composition Sb5. Provide non-corrosive

flux. 2.6 STRAINERS

- A. Provide on high pressure side of pressure reducing valves, on suction side of pumps, on inlet side of indicating and control instruments and equipment subject to sediment damage and where shown on drawings. Strainer element shall be removable without disconnection of piping.
- B. Water: Basket or "Y" type with easily removable cover and brass strainer basket.
- C. Body: Smaller than 80 mm (3 inches), brass or bronze; 80 mm (3 inches) and larger, cast iron or semi-steel.

2.7 DIELECTRIC FITTINGS

- A. Provide dielectric couplings or unions between ferrous and non-ferrous pipe.

2.8 STERILIZATION CHEMICALS

- A. Hypochlorites ANSI/AWWA B300-10
- B. Liquid Chlorine ANSI/AWWA B301-10

2.9 WATER HAMMER ARRESTER:

- A. Closed copper tube chamber with permanently sealed 410 kPa (60 psig) air charge above a Double O-ring piston. Two high heat Buna-N O-rings pressure packed and lubricated with FDA approved silicone compound. All units shall be designed in accordance with ASSE 1010 for sealed wall installations without an access panel. Size and install in accordance with Plumbing and Drainage Institute requirements (PDI WH 201). Provide water hammer arrestors at:
 - 1. All solenoid valves.
 - 2. All groups of two or more flush valves.
 - 3. All quick opening or closing valves.
 - 4. All medical washing equipment.

PART 3 - EXECUTION**3.1 INSTALLATION**

- A. General: Comply with the International Plumbing Code and the following:
 1. Install branch piping for water from the piping system and connect to all fixtures, valves, cocks, outlets, casework, cabinets and equipment, including those furnished by the Government or specified in other sections.

2. Pipe shall be round and straight. Cutting shall be done with proper tools. Pipe, except for plastic and glass, shall be reamed to full size after cutting.
3. All pipe runs shall be laid out to avoid interference with other work.
4. Install union and shut-off valve on pressure piping at connections to equipment.
5. Pipe Hangers, Supports and Accessories:
 - a. All piping shall be supported per the International Plumbing Code.
 - b. Shop Painting and Plating: Hangers, supports, rods, inserts and accessories used for pipe supports shall be shop coated with red lead or zinc chromate primer paint. Electroplated copper hanger rods, hangers and accessories may be used with copper tubing.
 - c. Floor, Wall and Ceiling Plates, Supports, Hangers:
 - 1) Solid or split unplated cast iron.
 - 2) All plates shall be provided with set screws.
 - 3) Pipe Hangers: Height adjustable clevis type.
 - 4) Adjustable Floor Rests and Base Flanges: Steel.
 - 5) Concrete Inserts: "Universal" or continuous slotted type.
 - 6) Hanger Rods: Mild, low carbon steel, fully threaded or Threaded at each end with two removable nuts at each end for positioning rod and hanger and locking each in place.
 - 7) Riser Clamps: Malleable iron or steel.
 - 8) Rollers: Cast iron.
 - 9) Self-drilling type expansion shields shall be "Phillips" type, with case hardened steel expander plugs.
 - 10) Hangers and supports utilized with insulated pipe and tubing shall have 180 degree (min.) metal protection shield Centered on and welded to the hanger and support. The shield shall be 4 inches in length and be 16 gauge steel. The shield shall be sized for the insulation.
 - 11) Miscellaneous Materials: As specified, required, directed or as noted on the drawings for proper installation of hangers, supports and accessories. If the vertical distance exceeds 6 m (20 feet) for cast iron pipe additional support shall be provided in the center of that span. Provide all necessary auxiliary steel to provide that support.

- 12) With the installation of each flexible expansion joint, provide piping restraints for the upstream and downstream section of the piping at the flexible expansion joint. Provide calculations supporting the restraint length design and type of selected restraints.
6. Install chrome plated cast brass escutcheon with set screw at each wall, floor and ceiling penetration in exposed finished locations and within cabinets and millwork.
7. Penetrations:
- a. Fire Stopping: Where pipes pass through fire partitions, fire walls, smoke partitions, or floors, install a fire stop that provides an effective barrier against the spread of fire, smoke and gases as specified in Section 07 84 00, FIRESTOPPING. Completely fill and seal clearances between raceways and openings with the fire stopping materials.
 - b. Waterproofing: At floor penetrations, completely seal clearances around the pipe and make watertight with sealant as specified in Section 07 92 00, JOINT SEALANTS.
- B. Piping shall conform to the following:
1. Domestic Water:
 - a. Grade all lines to facilitate drainage. Provide drain valves at bottom of risers and all low points in system. Design domestic hot water circulating lines with no traps.
 - b. Connect branch lines at bottom of main serving fixtures below and pitch down so that main may be drained through fixture. Connect branch lines to top of main serving only fixtures located on floor above.

3.2 TESTS

- A. General: Test system either in its entirety or in sections.
- B. Potable Water System: Test after installation of piping and domestic water heaters, but before piping is concealed, before covering is applied, and before plumbing fixtures are connected. Fill systems with water and maintain hydrostatic pressure of 690 kPa (100 psi) gage for two hours. No decrease in pressure is allowed. Provide a pressure gage with a shutoff and bleeder valve at the highest point of the piping being tested.

- C. Reagent Grade Water Systems: Fill system with water and maintain hydrostatic pressure of 690 kPa (100 psi) gage during inspection and prove tight.
- D. All Other Piping Tests: Test new installed piping under 1 1/2 times actual operating conditions and prove tight.

3.3 STERILIZATION

- A. After tests have been successfully completed, thoroughly flush and sterilize the interior domestic water distribution system in accordance with AWWA C651.
- B. Use liquid chlorine or hypochlorites for sterilization.

- - - E N D - - -

SECTION 22 11 23
DOMESTIC WATER PUMPS

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Hot water recirculation pump.

1.2 RELATED WORK

- A. Section 22 05 11, COMMON WORK RESULTS FOR PLUMBING.
 B. Section 22 05 12, GENERAL MOTOR REQUIREMENTS FOR PLUMBING EQUIPMENT.
 C. Section 26 29 11, LOW-VOLTAGE MOTOR

STARTERS. 1.4 SUBMITTALS

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Manufacturer's Literature and Data:
1. Pump:
 - a. Manufacturer and model.
 - b. Operating speed.
 - c. Capacity.
 - d. Characteristic performance curves.
 2. Motor:
 - a. Manufacturer.
 - b. Speed.
 - c. Current Characteristics.
 - d. Efficiency.
- C. Certificate of shop test for domestic water booster system. Provide certified performance curves.
- D. Certified copies of all the factory and construction site test data sheets and reports.
- E. Complete operating and maintenance manuals including wiring diagrams, technical data sheets and information for ordering replaceable parts:
1. Include complete list indicating all components of the systems.
 2. Include complete diagrams of the internal wiring for each item of equipment.
 3. Diagrams shall have their terminals identified to facilitate installation, operation and maintenance.
- F. Completed System Readiness Checklist provided by the Commissioning Agent and completed by the contractor, signed by a qualified technician and dated on the date of completion, in accordance with the requirements of Section 22 08 00 COMMISSIONING OF PLUMBING SYSTEMS.

1.5 APPLICABLE PUBLICATIONS

The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.

National Electrical Manufacturers Association (NEMA):

ICS6-93 (R2006) Industrial Control and Systems Enclosures
250-08Enclosures for Electrical Equipment (1000 Volts
Maximum)

American Society of Mechanical Engineers (ASME):

Boiler and Pressure Vessel Code: 2010
Section VIIIPressure Vessels, Division I and II

Underwriters' Laboratories, Inc. (UL):

508-99 (R2008) Standards for Industrial Control Equipment

PART 2 - PRODUCTS

2.1 INLINE HOT WATER RECIRCULATING PUMP

Centrifugal in-line horizontal oil lubricated pump designed for quiet operation and 862 kPa (125 psi).

Bronze body construction capable of pumping 37.9 LPM (10 GPM) @ 2.43 Meters of head (8 Feet of head) when drive by 1/12 HP single phase, 115 VAC motor. Pump shall be non-overloading at any point on the pump curve.

Pump controlled from on/off aquastat located at pump. In addition, the pump shall be provided with "on-off" switch for shut down. In the inlet and outlet piping of the pump shutoff valves shall be installed to permit service to the pump without draining the system. A check valve shall be installed in the pump discharge piping immediately downstream of the pump.

PART 3 - EXECUTION

3.1 STARTUP AND TESTING

Make tests as recommended by product manufacturer and listed standards and under actual or simulated operating conditions and prove full compliance with design and specified requirements. Tests of the various items of equipment shall be performed simultaneously with the system of which each item is an integral part.

System Test: After installation is completed provide an operational test of the completed system including flow rates, pressure compliance, alarms and all control functions.

When any defects are detected, correct defects and repeat test.

D. The Commissioning Agent will observe startup and contractor testing of selected equipment. Coordinate the startup and contractor testing schedules with the COTR and Commissioning Agent. Provide a minimum of 7 days prior to notice.

3.2 DEMONSTRATION AND TRAINING

Provide services of manufacturer's technical representative for four hours to instruct VA Personnel in operation and maintenance of units. Submit training plans and instructor qualifications in accordance with the requirements of Section 22 08 00 COMMISSIONING OF PLUMBING SYSTEMS.

- - - E N D - - -

THIS PAGE INTENTIONALLY LEFT BLANK

SECTION 22 13 00
FACILITY SANITARY AND VENT PIPING

PART 1 - GENERAL

1.1 DESCRIPTION

This section pertains to sanitary sewer and vent systems, including piping, equipment and all necessary accessories as designated in this section.

1.2 RELATED WORK

- A. Section 07 84 00, FIRESTOPPING: Penetrations in rated enclosures.
- B. Section 09 91 00, PAINTING: Preparation and finish painting and identification of piping systems.
- C. Section 22 05 11, COMMON WORK RESULTS FOR PLUMBING: Pipe Hangers and Supports, Materials Identification.
- D. Section 23 07 11, HVAC, PLUMBING, AND BOILER PLANT INSULATION: Pipe Insulation.
- E. Section 07 92 00 Joint Sealants: Sealant products.

1.3 SUBMITTALS

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, and SAMPLES.
- B. Manufacturer's Literature and Data:
 - Piping.
 - Floor Drains.
 - Grease Removal Unit.
 - Cleanouts.
 All items listed in Part 2 - Products.
- C. Detailed shop drawing of clamping device and extensions when required in connection with the waterproofing membrane or the floor drain.

1.4 APPLICABLE PUBLICATIONS

The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.

- American Society of Mechanical Engineers (ASME): (Copyrighted Society)
- A112.6.3-01 (R 2007) .. Standard for Floor and Trench Drains
 - A13.1-07 Scheme for Identification of Piping Systems
 - B16.3-06 Malleable Iron Threaded Fittings, Classes 150 and 300.
 - B16.4-06 Standard for Grey Iron Threaded Fittings
Classes 125 and 250

B16.12-98 (R 2006)Cast Iron Threaded Drainage Fittings
 B16.15-06Cast Bronze Threaded Fittings, Classes 125 and
 250

American Society for Testing and Materials (ASTM):

A47/A47M-99 (R 2004) .. Standard Specification for Steel Sheet,
 Aluminum Coated, by the Hot Dip Process
 A53/A53M-07 Standard Specification for Pipe, Steel, Black
 And Hot-Dipped, Zinc-coated, Welded and
 Seamless
 A74-06 Standard Specification for Cast Iron Soil Pipe
 and Fittings
 A183-03 Standard Specification for Carbon Steel Track
 Bolts and Nuts
 A536-84(R 2004) Standard Specification for Ductile Iron
 Castings
 B32-08Standard Specification for Solder Metal
 B75-02Standard Specification for Seamless Copper Tube
 B306-02*Standard Specification for Copper Drainage Tube*
 (DWV)
 B584-06aStandard Specification for Copper Alloy Sand
 Castings for General Applications
 C564-03a Standard Specification for Rubber Gaskets for
 Cast Iron Soil Pipe and Fittings
 D2000-08 Standard Classification System for Rubber
 Products in Automotive Applications
 D2564-04E1 Standard Specification for Solvent Cements for
 Poly (Vinyl Chloride) (PVC) Plastic Pipe and
 Fittings
 D2665-08*Standard Specification for Poly (Vinyl*
Chloride) (PVC) Plastic Drain, Waste, and Vent
Pipe and Fittings

International Code Council:

IPC-06International Plumbing Code

Cast Iron Soil Pipe Institute (CISPI):

301-05 Hubless Cast Iron Soil Pipe and Fittings for
 Sanitary and Storm Drain, Waste, and Vent
 Piping Applications

310-04 Coupling for Use in Connection with Hubless
Cast Iron Soil Pipe and Fittings for Sanitary
and Storm Drain, Waste, and Vent Piping
Applications

American Society of Sanitary Engineers (ASSE):

1018-01 Trap Seal Primer Valves - Potable, Water
Supplied

Plumbing and Drainage Institute (PDI):

PDI WH-201 Water Hammer Arrestor

PART 2 - PRODUCTS

2.1 SANITARY WASTE, DRAIN, AND VENT PIPING

A. Cast iron waste, drain, and vent pipe and fittings

1. Cast iron waste, drain, and vent pipe and fittings shall be used
for the following applications:

pipe buried in or in contact with earth

sanitary pipe extensions to a distance of approximately 1500 mm (5
feet) outside of the building.

interior waste and vent piping above grade.

2. Cast iron Pipe shall be bell and spigot or hubless (plain end or
no-hub or hubless).

3. The material for all pipe and fittings shall be cast iron soil pipe
and fittings and shall conform to the requirements of CISPI
Standard 301, ASTM A-888, or ASTM A-74.

4. Joints for hubless pipe and fittings shall conform to the
manufacturer's installation instructions. Couplings for hubless
joints shall conform to CISPI 310. Joints for hub and spigot pipe
shall be installed with compression gaskets conforming to the
requirements of ASTM Standard C-564 or be installed with lead and
oakum.

B. Copper Tube, (DWV):

Copper DWV tube sanitary waste, drain and vent pipe may be used for
piping above ground, except for urinal drains.

The copper DWV tube shall be drainage type, drawn temper conforming
to ASTM B306.

The copper drainage fittings shall be cast copper or wrought copper
conforming to ASME B16.23 or ASME 16.29.

The joints shall be lead free, using a water flushable flux, and
conforming to ASTM B32.

C. Polyvinyl Chloride (PVC)

1. Polyvinyl chloride (PVC) pipe and fittings are permitted where the waste temperature is below 60°C (140°F).

2. PVC piping and fittings shall NOT be used for the following applications:

Waste collected from steam condensate drains spaces such as mechanical equipment rooms, kitchens, SPD, and sterilizer areas.

b. Vertical waste and soil stacks serving more than two floors Exposed in mechanical equipment rooms.

Exposed inside of ceiling return plenums

3. Polyvinyl chloride sanitary waste, drain, and vent pipe and fittings shall be schedule 40 solid core sewer piping conforming to ASTM D 1785 and ASTM D2665, sewer and drain series with ends for solvent cemented joints.

4. Fittings:

a. PVC fittings shall be solvent welded socket type using solvent cement conforming to ASTM D2564.

2.2 EXPOSED WASTE PIPING

A. Full iron pipe size chrome plated brass piping shall be used in finished rooms for exposed waste piping connecting fixtures, casework, cabinets, equipment and reagent racks when not concealed by apron including those furnished by the Government or specified in other sections.

The Pipe shall meet Fed. Spec. WW-P-351, standard weight.

The Fittings shall conform to ANSI B16.15, cast bronze threaded fittings with chrome finish, (125 and 250).

Nipples shall conform to ASTM B 687, Chromium-plated.

Unions shall be brass or bronze with chrome finish. Unions 65 mm (2-1/2 inches) and larger shall be flange type with approved gaskets.

B. In unfinished Rooms such as mechanical Rooms and Kitchens, Chrome-plated brass piping is not required. The pipe materials specified under the paragraph "Sanitary Waste, Drain, and Vent Piping" can be used. The sanitary pipe in unfinished rooms shall be painted as specified in Section 09 91 00, PAINTING.

2.3 SPECIALTY PIPE FITTINGS

- A. Transition pipe couplings shall join piping with small differences in outside diameters or different materials. End connections shall be of the same size and compatible with the pipes being joined. The transition coupling shall be elastomeric, sleeve type reducing or transition pattern and include shear and corrosion resistant metal, tension band and tightening mechanism on each end. The transition coupling sleeve coupling shall be of the following material:
For cast iron soil pipes, the sleeve material shall be rubber conforming to ASTM C564.
For PVC soil pipes, the sleeve material shall be elastomeric seal or PVC, conforming to ASTM F 477 or ASTM D5926.
For dissimilar pipes, the sleeve material shall be PVC conforming to ASTM D5926, or other material compatible with the pipe materials being joined.
- B. The dielectric fittings shall conform to ASSE 1079 with a pressure rating of 860 kPa (125 psig) at a minimum temperature of 82°C (180°F). The end connection shall be solder joint copper alloy and threaded ferrous.
- C. Dielectric flange insulating kits shall be of non conducting materials for field assembly of companion flanges with a pressure rating of 1035 kPa (150 psig). The gasket shall be neoprene or phenolic. The bolt sleeves shall be phenolic or polyethylene. The washers shall be phenolic with steel backing washers.
- D. The di-electric nipples shall be electroplated steel nipple complying with ASTM F 1545 with a pressure ratings of 2070 kPa (300 psig) at 107°C (225°F). The end connection shall be male threaded. The lining shall be inert and noncorrosive propylene.

2.4 CLEANOUTS

Cleanouts shall be the same size as the pipe, up to 100 mm (4 inches); and not less than 100 mm (4 inches) for larger pipe. Cleanouts shall be easily accessible and shall be gastight and watertight. Minimum clearance of 600 mm (24 inches) shall be provided for clearing a clogged sanitary line.

Floor cleanouts shall be gray iron housing with clamping device and round, secured, scoriated, gray iron cover conforming to ASME A112.36.2M. A gray iron ferrule with hubless, socket, inside calk or spigot connection and counter sunk, taper-thread, brass or bronze

closure plug shall be included. The frame and cover material and finish shall be nickel-bronze copper alloy with a square shape. The cleanout shall be vertically adjustable for a minimum of 50 mm (2 inches). When a waterproof membrane is used in the floor system, clamping collars shall be provided on the cleanouts. Cleanouts shall consist of wye fittings and eighth bends with brass or bronze screw plugs. Cleanouts in the resilient tile floors, quarry tile and ceramic tile floors shall be provided with square top covers recessed for tile insertion. In the carpeted areas, carpet cleanout markers shall be provided. Two way cleanouts shall be provided where indicated on drawings and at every building exit. The loading classification for cleanouts in sidewalk areas or subject to vehicular traffic shall be heavy duty type.

Cleanouts shall be provided at or near the base of the vertical stacks with the cleanout plug located approximately 600 mm (24 inches) above the floor. If there are no fixtures installed on the lowest floor, the cleanout shall be installed at the base of the stack. The cleanouts shall be extended to the wall access cover. Cleanout shall consist of sanitary tees. Nickel-bronze square frame and stainless steel cover with minimum opening of 150 by 150 mm (6 by 6 inches) shall be furnished at each wall cleanout. Where the piping is concealed, a fixture trap or a fixture with integral trap, readily removable without disturbing concealed pipe, shall be accepted as a cleanout equivalent providing the opening to be used as a cleanout opening is the size required.

In horizontal runs above grade, cleanouts shall consist of cast brass tapered screw plug in fitting or caulked/hubless cast iron ferrule. Plain end (hubless) piping in interstitial space or above ceiling may use plain end (hubless) blind plug and clamp.

2.5 FLOOR DRAINS

A. Type A (FD-A) floor drain shall comply with ANSI A112.6.3. A caulking flange, inside gasket, or hubless connection shall be provided for connection to cast iron pipe, screwed or no hub outlets for connection to steel pipe. The drain connection shall be bottom outlet. A membrane clamp and extensions shall be provided, if required, where installed in connection with waterproof membrane. Puncturing membrane other than for drain opening will not be permitted. Double drainage pattern floor drains shall have integral seepage pan for embedding into

floor construction, and weep holes to provide adequate drainage from pan to drain pipe. For drains not installed in connection with a waterproof membrane, a 2.2 kg (16-ounce) soft copper membrane, 600 mm (24 inches) square or another approved waterproof membrane shall be provided.

Type F (FD-F) floor drain shall comply with ANSI A112.6.3. The type F floor drain shall have a cast iron body with flange, integral reversible clamping device, seepage openings and a 225 mm (9 inch) two-piece satin nickel-bronze or satin bronze strainer for use with seamless vinyl floors.

Type H (FD-H) floor drain shall comply with ANSI A112.6.3. The type H drain shall have a cast iron body, double drainage pattern, without sediment bucket but with loose set nickel bronze grate, secondary strainer, and integral clamping collar. The grate shall be 300 mm (12 inches) in diameter or 300 mm (12 inches) square. The drain body shall be 150 mm (6 inches) deep.

Open Sight Drains (OSDs) shall be cast iron, constructed as shown by detail.

2.6 TRAPS

A. Traps shall be provided on all sanitary branch waste connections from fixtures or equipment not provided with traps. Exposed brass shall be polished brass chromium plated with nipple and set screw escutcheons. Concealed traps may be rough cast brass or same material as pipe connected to. Slip joints are not permitted on sewer side of trap. Traps shall correspond to fittings on cast iron soil pipe or steel pipe respectively, and size shall be as required by connected service or fixture.

2.7 TRAP SEAL PRIMER VALVES AND TRAP SEAL PRIMER SYSTEMS

A. Trap Primer (TP-1): The trap seal primer system shall be electronic type conforming to ASSE 1044.

The controller shall have a 24 hour programmable timer, solid state, 6 outlet zones, minimum adjustable run time of 1 minute for each zone, 12 hour program battery backup, manual switch for 120VAC power, 120VAC to 24VAC internal transformer, fuse protected circuitry, UL listed, 120VAC input-24VAC output, constructed of enameled steel or plastic.

The cabinet shall be recessed mounting with a stainless steel cover.

The solenoid valve shall have a brass body, Buna "N" seats, normally closed, 5.98 kPa (125 psi) rated, 24VAC.

The control wiring shall be copper in accordance with the latest edition of the National Electric Code, Article 725 and not less than 18 gauge. All wiring shall be in conduit and in accordance with Division 26 of the specifications.

The vacuum breaker shall conform to ASSE 1001.

- B. Trap Primer (TP-2): The trap seal primer valve shall be hydraulic, supply type with a pressure rating of 5.98 kPa (125 psig) and conforming to standard ASSE 1018.

The inlet and outlet connections shall be 15 mm or DN15 (NPS 1/2 inch) The trap seal primer valve shall be fully automatic with an all brass or bronze body.

The trap seal primer valve shall be activated by a drop in building water pressure, no adjustment required.

The trap seal primer valve shall include a manifold when serving two, three, or four traps.

The manifold shall be omitted when serving only one trap.

2.8 WATERPROOFING

A sleeve flashing device shall be provided at points where pipes pass through membrane waterproofed floors or walls. The sleeve flashing device shall be manufactured, cast iron fitting with clamping device that forms a sleeve for the pipe floor penetration of the floor membrane. A galvanized steel pipe extension shall be included in the top of the fitting that will extend 50 mm (2 inches) above finished floor and galvanized steel pipe extension in the bottom of the fitting that will extend through the floor slab. A waterproof caulked joint shall be provided at the top hub.

Walls: See detail shown on drawings.

PART 3 - EXECUTION

3.1 PIPE INSTALLATION

The pipe installation shall comply with the requirements of the International Plumbing Code (IPC) and these specifications.

Branch piping shall be installed for waste from the respective piping systems and connect to all fixtures, valves, cocks, outlets, casework, cabinets and equipment, including those furnished by the Government or specified in other sections.

Pipe shall be round and straight. Cutting shall be done with proper tools. Pipe shall be reamed to full size after cutting.

All pipe runs shall be laid out to avoid interference with other work. The piping shall be installed above accessible ceilings where possible. The piping shall be installed to permit valve servicing or operation. Unless specifically indicated on the drawings, the minimum slope shall be 2% slope.

The piping shall be installed free of sags and bends.

Seismic restraint shall be installed where required by code.

Changes in direction for soil and waste drainage and vent piping shall be made using appropriate branches, bends and long sweep bends.

Sanitary tees and short sweep quarter bends may be used on vertical stacks if change in direction of flow is from horizontal to vertical. Long turn double wye branch and eighth bend fittings shall be used if two fixtures are installed back to back or side by side with common drain pipe. Straight tees, elbows, and crosses may be used on vent lines. Do not change direction of flow more than 90 degrees. Proper size of standard increaser and reducers shall be used if pipes of different sizes are connected. Reducing size of drainage piping in direction of flow is prohibited.

Buried soil and waste drainage and vent piping shall be laid beginning at the low point of each system. Piping shall be installed true to grades and alignment indicated with unbroken continuity of invert. Hub ends shall be placed upstream. Required gaskets shall be installed according to manufacturer's written instruction for use of lubricants, cements, and other installation requirements.

Cast iron piping shall be installed according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook," Chapter IV, "Installation of Cast Iron Soil Pipe and Fittings"

Aboveground copper tubing shall be installed according to CDA's "Copper Tube Handbook".

Aboveground PVC piping shall be installed according to ASTM D2665.

Underground PVC piping shall be installed according to ASTM D2321. **3.2 JOINT CONSTRUCTION**

A. Hub and spigot, cast iron piping with gasket joints shall be joined in accordance with CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for compression joints.

- B. Hub and spigot, cast iron piping with calked joints shall be joined in accordance with CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for lead and oakum calked joints.
- C. Hubless or No-hub, cast iron piping shall be joined in accordance with CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for hubless piping coupling joints.
- D. For threaded joints, thread pipe with tapered pipe threads according to ASME B1.20.1. The threads shall be cut full and clean using sharp disc cutters. Threaded pipe ends shall be reamed to remove burrs and restored to full pipe inside diameter. Pipe fittings and valves shall be joined as follows:
 Apply appropriate tape or thread compound to external pipe threads unless dry seal threading is required by the pipe service
 Pipe sections with damaged threads shall be replaced with new sections of pipe.
- E. Copper tube and fittings with soldered joints shall be joined according to ASTM B828. A water flushable, lead free flux conforming to ASTM B813 and a lead free alloy solder conforming to ASTM B32 shall be used.
- F. For PVC piping, solvent cement joints shall be used for joints. All surfaces shall be cleaned and dry prior to applying the primer and solvent cement. Installation practices shall comply with ASTM F402. The joint shall conform to ASTM D2855 and ASTM D2665 appendixes.

3.3 SPECIALTY PIPE FITTINGS

- Transition coupling shall be installed at pipe joints with small differences in pipe outside diameters.
- Dielectric fittings shall be installed at connections of dissimilar metal piping and tubing.

3.4 PIPE HANGERS, SUPPORTS AND ACCESSORIES:

- All piping shall be supported according to the International Plumbing Code (IPC), Section 22 05 11, COMMON WORK RESULTS FOR PLUMBING, and these specifications. Where conflicts arise between these the code and Section 22 05 11, the most restrictive or the requirement that specifies supports with highest loading or shortest spacing shall apply.

Hangers, supports, rods, inserts and accessories used for pipe supports shall be shop coated with zinc chromate primer paint. Electroplated copper hanger rods, hangers and accessories may be used with copper tubing.

- C. Horizontal piping and tubing shall be supported within 300 mm (12 inches) of each fitting or coupling.
- D. Horizontal cast iron piping shall be supported with the following maximum horizontal spacing and minimum hanger rod diameters:
- 40 mm or DN40 to 50 mm or DN50 (NPS 1-1/2 inch to NPS 2 inch): 1500 mm (60 inches) with 10 mm (3/8 inch) rod.
 - 80 mm or DN 80 (NPS 3 inch): 1500 mm (60 inches) with 13 mm (1/2 inch) rod.
 - 100 mm or DN100 to 125 mm or DN125 (NPS 4 to NPS 5): 1500 mm (60 inches) with 16 mm (5/8 inch) rod.
 - 150 mm or DN150 to 200 mm or DN200 (NPS 6 inch to NPS 8 inch): 1500 mm (60 inches) with 19 mm (3/4 inch) rod.
 - 250 mm or DN250 to 300 mm or DN 300 (NPS 10 inch to NPS 12 inch): 1500 mm (60 inch) with 22 mm (7/8 inch) rod.
- E. The maximum spacing for plastic pipe shall be 1.22 m (4 feet).
- F. Vertical piping and tubing shall be supported at the base, at each floor, and at intervals no greater than 4.57 m (15 feet).
- G. In addition to the requirements in Section 22 05 11, COMMON WORK RESULTS FOR PLUMBING, floor, Wall and Ceiling Plates, Supports, Hangers shall have the following characteristics:
- Solid or split unplated cast iron.
 - All plates shall be provided with set screws.
 - Height adjustable clevis type pipe hangers.
 - Adjustable floor rests and base flanges shall be steel.
 - Hanger rods shall be low carbon steel, fully threaded or threaded at each end with two removable nuts at each end for positioning rod and hanger and locking each in place.
 - Riser clamps shall be malleable iron or steel.
 - Rollers shall be cast iron.
 - See Section 22 05 11, COMMON WORK RESULTS FOR PLUMBING, for requirements on insulated pipe protective shields at hanger supports.
- H. Miscellaneous materials shall be provided as specified, required, directed or as noted on the drawings for proper installation of hangers, supports and accessories. If the vertical distance exceeds 6 m (20 feet) for cast iron pipe additional support shall be provided in the center of that span. All necessary auxiliary steel shall be provided to provide that support.

I. Cast escutcheon with set screw shall be provided at each wall, floor and ceiling penetration in exposed finished locations and within cabinets and millwork.

J. Penetrations:

Fire Stopping: Where pipes pass through fire partitions, fire walls, smoke partitions, or floors, a fire stop shall be installed that provides an effective barrier against the spread of fire, smoke and gases as specified in Section 07 84 00, FIRESTOPPING. Clearances between raceways and openings shall be completely filled and sealed with the fire stopping materials.

Water proofing: At floor penetrations, clearances shall be completely sealed around the pipe and make watertight with sealant as specified in Section 07 92 00, JOINT SEALANTS.

K. Piping shall conform to the following:

Waste and Vent Drain to main stacks:

Pipe Size	Minimum Pitch
80 mm or DN 80 (3 inches) and smaller	2%
100 mm or DN 100 (4 inches) and larger	1%

Exhaust vents shall be extended separately through roof. Sanitary vents shall not connect to exhaust vents.

3.5 TESTS

Sanitary waste and drain systems shall be tested either in its entirety or in sections.

Waste System tests shall be conducted before trenches are backfilled or fixtures are connected. A water test or air test shall be conducted, as directed.

1. If entire system is tested for a water test, tightly close all openings in pipes except highest opening, and fill system with water to point of overflow. If the waste system is tested in sections, tightly plug each opening except highest opening of section under test, fill each section with water and test with at least a 3 m (10 foot) head of water. In testing successive sections, test at least upper 3 m (10 feet) of next preceding section so that each joint or pipe except upper most 3 m (10 feet) of system has been submitted to

a test of at least a 3 m (10 foot) head of water. Water shall be kept in the system, or in portion under test, for at least 15 minutes before inspection starts. System shall then be tight at all joints.

For an air test, an air pressure of 35 kPa (5 psig) gage shall be maintained for at least 15 minutes without leakage. A force pump and mercury column gage shall be used for the air test.

After installing all fixtures and equipment, open water supply so that all p-traps can be observed. For 15 minutes of operation, all p-traps shall be inspected for leaks and any leaks found shall be corrected.

3. Final Tests: Either one of the following tests may be used.

Smoke Test: After fixtures are permanently connected and traps are filled with water, fill entire drainage and vent systems with smoke under pressure of 1.3 kPa (1 inch of water) with a smoke machine. Chemical smoke is prohibited.

Peppermint Test: Introduce (2 ounces) of peppermint into each line or stack.

- - - E N D - - -

THIS PAGE INTENTIONALLY LEFT BLANK

**SECTION 22 14 00
FACILITY STORM DRAINAGE**

PART 1 - GENERAL

1.1 DESCRIPTION

This section describes the requirements for storm drainage systems, including piping and all necessary accessories as designated in this section.

1.2 RELATED WORK

Section 07 84 00, FIRESTOPPING: Penetrations in rated enclosures.

Section 09 91 00, PAINTING: Preparation and finish painting and identification of piping systems.

Section 22 05 11, COMMON WORK RESULTS FOR PLUMBING: Pipe Hangers and Supports, Materials Identification.

Section 23 07 11, HVAC, PLUMBING, AND BOILER PLANT INSULATION: Pipe Insulation.

1.3 SUBMITTALS

A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

B. Manufacturer's Literature and Data:

Piping.

Roof Drains.

Cleanouts.

All items listed in Part 2 - Products.

C. Detailed shop drawing of clamping device and extensions when required in connection with the waterproofing membrane.

1.4 APPLICABLE PUBLICATIONS

The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.

American National Standards Institute (ANSI).

American Society of Mechanical Engineers (ASME): (Copyrighted Society)

A112.21.2m-83 Roof Drains

A13.1-07 Scheme for Identification of Piping Systems

B16.3-06 Malleable Iron Threaded Fittings, Classes 150 and 300. B16.9-07 Factory-Made Wrought Steel Butt welding Fittings

- B16.11-05 Forged Steel Fittings, Socket-Welding and
Threaded B16.12-98 (R 2006) Cast Iron
Threaded Drainage Fittings
- B16.15-06) Cast Bronze Threaded Fittings, Class 125 and
250
- B16.18-01 (R 2005) Cast Copper Alloy Solder-Joint Pressure
Fittings
- B16.22-01 (R 2005) Wrought Copper and Copper Alloy Solder Joint
Pressure Fittings
- D. American Society for Testing and Materials (ASTM):
- A47-99 (R 2004) Standard Specification for Steel Sheet,
Aluminum Coated, by the Hot-Dip Process
- A53-07 Standard Specification for Pipe, Steel, Black
And Hot-Dipped, Zinc-coated Welded and Seamless
- A74-06 Standard Specification for Cast Iron Soil Pipe
and Fittings
- A183-03) Standard Specification for Carbon Steel Track
Bolts and Nuts
- A312-03 Standard Specification for Seamless and Welded
Austenitic Stainless Steel Pipe
- A536-84(R 2004) Standard Specification for Ductile Iron
Castings
- A733-03 Standard Specification for Welded and Seamless
Carbon Steel and Austenitic Stainless Steel
Pipe Nipples
- B32-04 Standard Specification for Solder Metal
- B61-08 Standard Specification for Steam or Bronze
Castings
- B62-02 Standard Specification for Composition Bronze
or Ounce Metal Castings
- B75-02 Standard Specification for Seamless Copper Tube
- B88-03 Standard Specification for Seamless Copper
Water Tube
- B306-02 Standard Specification for Copper Drainage Tube
(DWV)
- B584-08 Standard Specification for Copper Alloy Sand
Castings for General Applications

- B687-99 Standard Specification for Brass, Copper, and Chromium-Plated Pipe Nipples
- C564-06a Standard Specification for Rubber Gaskets for Cast Iron Soil Pipe and Fittings
- D2000-08 Standard Classification System for Rubber Products in Automotive Applications
- D4101-07 Standard Specification for Propylene Plastic Injection and Extrusion Materials
- D2447-03 Standard Specification for Polyethylene (PE) Plastic Pipe, Schedule 40 and 80, Based on Outside Diameter
- D2564-04e1 Standard Specification for Solvent Cements for Poly (Vinyl Chloride) (PVC) Plastic Pipe and Fittings
- D2665-07 Standard Specification for Poly (Vinyl Chloride) (PVC) Plastic Drain, Waste, and Vent Pipe and Fittings
- American Welding Society (AWS):
- A5.8-04 Specification for Filler Metals for Brazing and Braze Welding
- International Code Council (ICC):
- IPC-06 International Plumbing Code
- Cast Iron Soil Pipe Institute (CISPI):
- 301-05 Hubless Cast Iron Soil and Fittings for Sanitary and Storm Drain, Waste, and Vent Piping Applications
- 310-04 Couplings for Use in Connection with Hubless Cast Iron Soil and Fittings for Sanitary and Storm Drain, Waste, and Vent Piping Applications
- Manufacturers Standardization Society of the Valve and Fittings Industry, Inc. (MSS):
- SP-72-99 Standard for Ball Valves with Flanged or Butt Welding For General Purpose
- SP-110-96 Ball Valve Threaded, Socket Welding, Solder Joint, Grooved and Flared Ends

PART 2 - PRODUCTS**2.1 STORM WATER DRAIN PIPING****A. Cast Iron Storm Pipe and Fittings:**

1. Cast iron storm pipe and fittings shall be used for the following applications:

Pipe buried in or in contact with earth.

Extension of pipe to a distance of approximately 1500 mm (5 feet) outside of building walls.

Interior storm piping above grade.

All mechanical equipment rooms or other areas containing mechanical air handling equipment.

2. The cast iron storm Pipe shall be bell and spigot, or hubless (plain end or no-hub) as required by selected jointing method.
3. The material for all pipe and fittings shall be cast iron soil pipe and fittings and shall conform to the requirements of CISPI Standard 301, ASTM A-888, or ASTM A-74.
4. Joints for hubless pipe and fittings shall conform to the manufacturer's installation instructions. Couplings for hubless joints shall conform to CISPI 310. Joints for hub and spigot pipe shall be installed with compression gaskets conforming to the requirements of ASTM Standard C-564 or be installed with leak and oakum.

B. Copper Tube, (DWV): May be used for piping above ground.

The copper DWV tube shall be drainage type, drawn temper conforming to ASTM B306.

The Copper drainage fittings shall be cast copper or wrought copper conforming to ASME B16.23 or ASME 16.29.

The joints shall be lead free, using a water flushable flux, and conforming to ASTM B32.

C. Polyvinyl Chloride (PVC)

Polyvinyl chloride storm sewer pipe and fittings are permitted for single story structures except for mechanical equipment rooms and other areas containing air handling equipment or hot water generation equipment.

Polyvinyl chloride storm sewer pipe and fittings shall be schedule 40 solid core sewer piping conforming to ASTM D1785 and D 2665, Sewer and Drain Series, with ends for solvent cemented joints.

3. Polyvinyl chloride joints shall be solvent welded socket type using solvent cement conforming to ASTM D2564.

- D. Roof drain piping in locations where the outdoor conditions are subject to freezing shall be insulated.

2.2 SPECIALTY PIPE FITTINGS

- A. Transition pipe couplings shall join piping with small differences in outside diameters or be of different materials. End connections shall be of the same size and compatible with the pipes being joined. The transition coupling shall be elastomeric, sleeve type reducing or transition pattern and include shear erring and corrosion resistant metal tension band and tightening mechanism on each end. The transition coupling sleeve coupling shall be of the following material: For cast iron soil pipes, the sleeve material shall be rubber conforming to ASTM C564.

For PVC soil pipes, the sleeve material shall be elastomeric seal or PVC, conforming to ASTM F 477 or ASTM D5926.

For dissimilar pipes, the sleeve material shall be PVC conforming to ASTM D5926, or other material compatible with the pipe materials being joined.

- B. The dielectric fittings shall conform to ASSE 1079 with a pressure rating of 860 kPa (125 psig) at a minimum temperature of 82°C (180°F). The end connection shall be solder joint copper alloy and threaded ferrous.
- C. Dielectric flange insulating kits shall be of non conducting materials for field assembly of companion flanges with a pressure rating of 1035 kPa (150 psig). The gasket shall be neoprene or phenolic. The bolt sleeves shall be phenolic or polyethylene. The washers shall be phenolic with steel backing washers.
- D. The dielectric nipples shall be electroplated steel nipple comply with ASTM F 1545 with a pressure ratings of 2070 kPa (300 psig) at 107°C (225°F). The end connection shall be male threaded. The lining shall be inert and noncorrosive propylene.

2.3 CLEANOUTS

- A. Cleanouts shall be the same size as the pipe, up to 100 mm (4 inches); not less than 100 mm (4 inches) for larger pipe. Cleanouts shall be easily accessible and shall be gastight and watertight. A minimum clearance of 600 mm (24 inches) shall be provided for clearing a clogged storm sewer line.

Floor cleanouts shall be gray iron housing with clamping device and round, secured, scoriated, gray iron cover conforming to ASME A112.36.2M. A gray iron ferrule with hubless, socket, inside calk or spigot connection and counter sunk, taper-thread, brass or bronze closure plug shall be included. The frame and cover material and finish shall be nickel-bronze copper alloy with a square shape. The cleanout shall be vertically adjustable for a minimum of 50 mm (2 inches). When a waterproof membrane is used in the floor system, clamping collars shall be provided on the cleanouts. Cleanouts shall consist of wye fittings and eighth bends with brass or bronze screw plugs. Cleanouts in the resilient tile floors, quarry tile and ceramic tile floors shall be provided with square top covers recessed for tile insertion. In the carpeted areas, carpet cleanout markers shall be provided. Two way cleanouts where shall be provided where indicated on the drawings and at each building exit. The loading classification for cleanouts in sidewalk areas or subject to vehicular traffic shall be heavy duty.

Cleanouts shall be provided at or near the base of the vertical stacks with the cleanout plug located approximately 600 mm (24 inches) above the floor. The cleanouts shall be extended to the wall access cover. Cleanout shall consist of sanitary tees. Nickel bronze square frame and stainless steel cover with minimum opening of 150 mm by 150 mm (6 inch by 6 inch) shall be provided at each wall cleanout.

In horizontal runs above grade, cleanouts shall consist of cast brass tapered screw plug in fitting or caulked/no hub cast iron ferrule. Plain end (no-hub) piping in interstitial space or above ceiling may use plain end (no-hub) blind plug and clamp.

2.4 ROOF DRAINS AND CONNECTIONS

A. Roof Drains: Roof Drains (RD) shall be cast iron with clamping device for making watertight connection. Free openings through strainer shall be twice area of drain outlet. For roof drains not installed in connection with a waterproof membrane, a soft copper membrane shall be provided 300 mm (12 inches) in diameter greater than outside diameter of drain collar. An integral gravel stop shall be provided for drains installed on roofs having built up roofing covered with gravel or slag. Integral no-hub, soil pipe gasket or threaded outlet connection shall be provided.

Flat Roofs: The roof drain shall have a beehive or dome shaped strainer with integral flange not less than 300 mm (12 inches) in diameter. For an insulated roof, a roof drain with an adjustable drainage collar shall be provided, which can be raised or lowered to meet required insulation heights, sump receiver and deck clamp. The Bottom section shall serve as roof drain during construction before insulation is installed.

Canopy Roofs: The roof drain shall have a beehive or dome shaped strainer with the integral flange not larger than 200 mm (8 inches) in diameter. For an insulated roof, the roof drain shall be provided with an adjustable drainage collar, which can be raised or lowered to meet the required insulation heights, sump receiver and deck clamp. Bottom section shall serve as roof drain during construction before insulation is installed.

Protective Roof Membrane Insulation Assembly: The roof drain shall have a perforated stainless steel extension filter, non puncturing clamp ring, large sump with extra wide roof flange and deck clamp.

a. Non pedestrian Roofs: The roof drain shall have large polypropylene or aluminum locking dome.

Roof Drains, Overflow: Roof Drains identified as overflow drains shall have a 50 mm (2 inch) water dam integral to the drain body.

Roof drains in areas subject to freezing shall have heat tape and shall be insulated.

Expansion Joints: Expansions joints shall be heavy cast iron with cast brass or copper expansion sleeve having smooth bearing surface working freely against a packing ring held in place and under pressure of a bolted gland ring, forming a water and air tight flexible joint. Asbestos packing is prohibited.

Interior Downspouts: An expansion joint shall be provided, specified above, at top of run on straight, vertical runs of downspout piping 12 m (40 feet) long or more.

Downspout Nozzle: The downspout nozzle fitting shall be of brass, unfinished, with internal pipe thread for connection to downspout.

2.6 WATERPROOFING

A sleeve flashing device shall be provided at points where pipes pass through membrane waterproofed floors or walls. The sleeve flashing device shall be manufactured, cast iron fitting with clamping device that forms a sleeve for the pipe floor penetration of the floor membrane. A galvanized steel pipe extension shall be included in the top of the fitting that will extend 50 mm (2 inches) above finished floor and galvanized steel pipe extension in the bottom of the fitting that will extend through the floor slab. A waterproofed caulked joint shall be provided at the top hub.

Walls: See detail shown on drawings.

PART 3 - EXECUTION

3.1 PIPE INSTALLATION

The pipe installation shall comply with the requirements of the International code and these specifications.

Branch piping shall be installed from the piping system and connect to all drains and outlets.

Pipe shall be round and straight. Cutting shall be done with proper tools. Pipe shall be reamed to full size after cutting.

All pipe runs shall be laid out to avoid interference with other work. The piping shall be installed above accessible ceilings to allow for ceiling panel removal.

Unless otherwise stated on the documents, minimum horizontal slope shall be one inch for every 1.22 m (4 feet) of pipe length.

The piping shall be installed free of sags and bends.

Seismic restraint shall be installed where required by code.

Changes in direction for storm drainage piping shall be made using appropriate branches, bends and long sweep bends. Sanitary tees and short sweep 1/4 bends may be used on vertical stacks if change in direction of flow is from horizontal to vertical. Long turn double wye branch and 1/8 bend fittings shall be used if two fixtures are installed back to back or side by side with common drain pipe. Do not change direction of flow more than 90 degrees. Proper size of standard increaser and reducers shall be used if pipes of different sizes are connected. Reducing size of drainage piping in direction of flow is prohibited.

Buried storm drainage piping shall be laid beginning at the low point of each system. Piping shall be installed true to grades and alignment indicated with unbroken continuity of invert. Hub ends shall be placed upstream. Required gaskets shall be installed according to manufacturer's written instruction for use of lubricants, cements, and other installation requirements.

Cast iron piping shall be installed according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook," Chapter IV, "Installation of Cast Iron Soil Pipe and Fittings"

Aboveground copper tubing shall be installed according to CDA's "Copper Tube Handbook".

Aboveground PVC piping shall be installed according to ASTM D2665.

Underground PVC piping shall be installed according to ASTM D2321. **3.2 JOINT CONSTRUCTION**

- A. Hub and spigot, cast iron piping with gasket joints shall be joined in accordance with CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for compression joints.
- B. Hub and spigot, cast iron piping with calked joints shall be joined in accordance with CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for lead and oakum calked joints.
- C. Hubless, cast iron piping shall be joined in accordance with CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for hubless piping coupling joints.
- D. For threaded joints, thread pipe with tapered pipe threads according to ASME B1.20.1. The threads shall be cut full and clean using sharp disc cutters. Threaded pipe ends shall be reamed to remove burrs and restored to full pipe inside diameter. Pipe fittings and valves shall be joined as follows:
 Apply appropriate tape or thread compound to external pipe threads unless dry seal threading is required by the pipe service
 Pipe sections with damaged threads shall be replaced with new sections of pipe.
- E. Copper tube and fittings with soldered joints shall be joined according to ASTM B828. A water flushable, lead free flux conforming to ASTM B813 and a lead free alloy solder conforming to ASTM B32 shall be used.

- F. for PVC piping, solvent cement joints shall be used for joints. All surfaces shall be cleaned and dry prior to applying the primer and solvent cement. Installation practices shall comply with ASTM F402. The joint shall conform to ASTM D2855 and ASTM D2665 appendixes.

3.3 SPECIALTY PIPE FITTINGS

Transition coupling shall be installed at pipe joints with small differences in pipe outside diameters.

Dielectric fittings shall be installed at connections of dissimilar metal piping and tubing.

3.4 PIPE HANGERS, SUPPORTS AND ACCESSORIES:

- A. All piping shall be supported according to the International plumbing code, Section 22 05 11, COMMON WORK RESULTS FOR PLUMBING, and these specifications.
- B. Hangers, supports, rods, inserts and accessories used for Pipe supports shall be shop coated with zinc Chromate primer paint. Electroplated copper hanger rods, hangers and accessories may be used with copper tubing.
- C. Horizontal piping and tubing shall be supported within 300 mm (12 inches) of each fitting or coupling.
- D. Horizontal cast iron piping shall be supported with the following maximum horizontal spacing and minimum hanger rod diameters:
- NPS 1-1/2 to NPS 2 (DN 40 to DN 50): 1500 mm (60 inches) with 10 mm (3/8 inch) rod.
- NPS 3 (DN 80): 1500 mm (60 inches) with 13 mm (1/2 inch) rod.
- NPS 4 to NPS 5 (DN 100 to DN 125): 1500 mm (60 inches) with 16 mm (5/8 inch) rod.
- NPS 6 to NPS 8 (DN 150 to DN 200): 1500 mm (60 inches) with 19 mm (3/4 inch) rod.
- NPS 10 to NPS 12 (DN 250 to DN 300): 1500 mm (60 inches) with 22 mm (7/8 inch) rod.
- E. The maximum support spacing for horizontal plastic shall be 1.22 m (4 feet).
- F. Vertical piping and tubing shall be supported at the base, at each floor, and at intervals no greater than 4.57 m (15 feet).

- G. In addition to the requirements in Section 22 05 11, COMMON WORK RESULTS FOR PLUMBING, floor, Wall and Ceiling Plates shall have the following characteristics:
- Solid or split unplated cast iron.
 - All plates shall be provided with set screws.
 - Height adjustable clevis type pipe hangers.
 - Adjustable Floor Rests and Base Flanges shall be steel.
 - Hanger Rods shall be low carbon steel, fully threaded or Threaded at each end with two removable nuts at each end for positioning rod and hanger and locking each in place.
 - Riser Clamps shall be malleable iron or steel.
 - Roller shall be cast iron.
 - Hangers and supports utilized with insulated pipe and tubing shall have 180 degree (min.) metal protection shield Centered on and welded to the hanger and support. The shield shall be 4 inches in length and be 16 gage steel. The shield shall be sized for the insulation.
- H. Miscellaneous Materials shall be provided as specified, required, directed or as noted on the drawings for proper installation of hangers, supports and accessories. If the vertical distance exceeds 6 m (20 feet) for cast iron pipe additional support shall be provided in the center of that span. All necessary auxiliary steel shall be provided to provide that support.
- I. Cast escutcheon with set screw shall be installed at each wall, floor and ceiling penetration in exposed finished locations and within cabinets and millwork.
- J. Penetrations:
- Fire Stopping: Where pipes pass through fire partitions, fire walls, smoke partitions, or floors, a fire stop shall be installed that provides an effective barrier against the spread of fire, smoke and gases as specified in Section 07 84 00, FIRESTOPPING. Clearances between raceways and openings shall be completely filled and sealed with the fire stopping materials.
 - Water proofing: At floor penetrations, Clearances around the pipe shall be completely sealed and made watertight with sealant as specified in Section 07 92 00, JOINT SEALANTS.

K. Piping shall conform to the following:

1. Storm Water Drain and Vent Drain to main stacks:

Pipe Size	Minimum Pitch
80 mm (3 inches) and smaller	2%
100 mm (4 inches) (4 inches) and larger	1%

3.5 TESTS

Storm sewer system shall be tested either in its entirety or in sections.

Storm Water Drain tests shall be conducted before trenches are backfilled or fixtures are connected. A water test or air test shall be conducted, as directed.

If entire system is tested with water, tightly close all openings in pipes except the highest opening, and fill system with water to point of overflow. If system is tested in sections, tightly plug each opening except highest opening of section under test, fill each section with water and test with at least a 3 m (10 foot) head of water. In testing successive sections, test at least upper 3 m (10 feet) of next preceding section so that each joint or pipe except upper most 3 m (10 feet) of system has been submitted to a test of at least a 3 m (10 foot) head of water. Water shall be kept in the system, or in portion under test, for at least 15 minutes before inspection starts. System shall then be tight at all joints.

For an air test, an air pressure of 35 kPa (5 psi) gage shall be maintained for at least 15 minutes without leakage. A force pump and mercury column gage shall be used for the test.

Final Tests: Either one of the following tests may be used.

Smoke Test: After fixtures are permanently connected and traps are filled with water, fill entire drainage and vent systems with smoke under pressure of 1.3 kPa (1 inch of water) with a smoke machine. Chemical smoke is prohibited.

Peppermint Test: Introduce .06 liters (2 ounces) of peppermint into each line or stack.

- - - E N D - - -

**SECTION 22 35 00
DOMESTIC WATER HEAT EXCHANGERS**

PART 1 - GENERAL

1.1 DESCRIPTION:

This section describes the requirements for domestic hot water heat exchangers including thermometers and all necessary accessories, connections and equipment.

1.2 RELATED WORK:

Section 09 91 00, PAINTING: Preparation and finish painting.

Section 22 05 11, COMMON WORK RESULTS FOR PLUMBING.

Section 22 11 23, DOMESTIC WATER PUMPS: Circulating Pump.

Section 23 07 11, HVAC, PLUMBING, AND BOILER PLANT INSULATION: Heater Insulation.

Section 22 05 19, METERS AND GAGES FOR PLUMBING PIPING, 22 05 23, GENERAL-DUTY VALVES FOR PLUMBING PIPING, and 22 11 00, FACILITY WATER DISTRIBUTION: Piping, Fittings, Valves and Gages.

1.3 SUBMITTALS:

A. Submit manufacturer's literature and data pertaining to the water heater in properly bound package, in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES. Include the following as a minimum:

Heat Exchangers.

Pressure and Temperature Relief Valves.

Steam Control Valves.

Thermometers.

Pressure Gages.

Vacuum Breakers.

B. Equipment components in contact with potable water shall meet NSF compliance requirements in document NSF 61, "Drinking Water System Components - Health Effects.

C. A form U-1 or other documentation stating compliance with the ASME Boiler and Pressure Vessel code.

1.4. APPLICABLE PUBLICATIONS:

The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.

American National Standard Institute (ANSI):

Z21.22-00/4.4A-00 Relief Valves for Hot Water Supply systems

C. American Society of Mechanical Engineers (ASME):

- B1.20.1-01 Pipe Threads, General Purpose
- B16.5-03 Pipe Flanges and Flanged Fittings, NPS 1/2
through NPS 24
- B16.24-06Cast Copper Alloy Pipe Flanges, Class 150,
300,600, 900, 1500, 2500
- PTC 25.3-02 Pressure Relief Devices
- Section IV-07Heating Boilers
- Section VIII-07Pressure Vessels Division 1

1.5 AS-BUILT DOCUMENTATION

The electronic documentation and copies of the Operations and Maintenance Manual, approved submittals, shop drawings, and other closeout documentation shall be prepared by a computer software program complying with Section 508 of the Rehabilitation Act of 1973, as amended (29 U.S.C 794d). The manufacturer or vendor of the software used to prepare the electronic documentation shall have a Voluntary Product Accessibility Template made available for review and included as part of the Operations and Maintenance Manual or closeout documentation. All available accessibility functions listed in the Voluntary Accessibility Template shall be enabled in the prepared electronic files. As Adobe Acrobat is a common industry format for such documentation, following the document, "Creating Accessible Adobe PDF files, A Guide for Document Authors" that is maintained and made available by Adobe free of charge is recommended."

Four sets of manufacturer's literature and data updated to include submittal review comments and any equipment substitutions.

Four sets of operation and maintenance data updated to include submittal review comments shall be inserted into a three ring binder. All aspects of system operation and maintenance procedures, including piping isometrics, wiring diagrams of all circuits, a written description of system design, control logic, and sequence of operation shall be included in the operation and maintenance manual. The operations and maintenance manual shall include troubleshooting techniques and procedures for emergency situations. Notes on all special systems or devices such as damper and door closure interlocks shall be included. A List of recommended spare parts (manufacturer, model number, and quantity) shall be furnished. Information explaining

required to employ shall be inserted into the As-Built documentation.

PART 2 - PRODUCTS

2.1 CIRCULATING DOMESTIC WATER HEAT EXCHANGERS

A packaged large capacity with hot water storage tank shall be provided with circulator, heat exchanger coil, controls, and specialties. The domestic water heat exchanger with circulator shall be based upon a standard flow arrangement with water from bottom of storage tank circulated across the heat exchanger coil and returned to tank.

A hot water outlet shall be included at the top of the tank.

A temperature sensor shall be located inside the storage tank.

A circulating pump complying with UL 778, all bronze construction, overhung impeller, and separately coupled inline pump shall be included. The pump shall have mechanical seals. The working pressure shall be rated at 860 kPa (125 psig).

The stand shall be factory fabricated for floor mounting.

The tappings shall be factory fabricated of materials compatible with heat exchanger shell. For sizes 50 millimeters or DN50 (NPS 2) and smaller, the tappings shall be threaded ends fabricated in accordance to ASME B1.20.1. For sizes 65 millimeters or DN65 (NPS 2-1/2) and larger, the tappings shall be flanged according to ASME B16.5 for steel and stainless steel flanges and ASME 16.24 for copper and copper alloy flanges.

Shell insulation shall comply with ASHRAE 890.1 and suitable for operating temperature. The entire shell and nozzles shall be completely surrounded except connections and controls.

The heat exchanger coils shall be constructed from copper and fabricated in a helix wound for steam heating medium. The pressure rating shall be equal to or greater than the steam supply pressure plus 50%.

The temperature controls shall be based upon an adjustable temperature transmitter that operates a control valve and is capable of maintaining outlet water temperature within 2°C (4°F) of setting.

Safety control shall be automatic, high temperature limit shutoff device.

K. The relief valves shall be ASME rated and stamped for combination temperature and pressure relief valves. One or more relief valves with total relieving capacity at least as great as heat input shall be included. The pressure setting shall be less than the working pressure rating of the heat exchanger minus 10 percent.

2.2 THERMOMETERS:

A. Thermometers shall be rigid stem or remote sensing, dial type with an aluminum, black metal, stainless steel, or chromium plated brass case. The thermometer shall be back connected, mercury, vapor, BI-metal or gas actuated, with circular dial 90 mm (3 1/2 inches) in diameter graduated from 4 to 100°C (40 to 210°F), with two-degree graduations guaranteed accurate within one scale division. The socket shall be separable, double-seat, micrometer-fittings, with extension neck not less than 65 mm (2 1/2 inches) to clear tank or pipe covering. The thermometer shall be suitable for 20 mm (3/4 inch) pipe threads. Thermometers may be consoles mounted with sensor installed in separate thermometer well.

2.3 SAFETY VALVES FOR SHELL AND STEAM HEATERS:

Separate temperature relief valve and pressure relief valve or combination pressure/temperature relief valves shall be provided on each water heater. The safety valve discharge shall be routed to nearest floor drain.

Temperature Relief Valves shall be constructed from all brass or bronze material. The temperature relief valves shall be automatic, self-closing reseating type valve, equipped with a noncorrosive metal thermostat with bulb extending into tank that can be manually displaced from its seat for test purposes. The temperature relief valve shall be tested and approved as to its BTU capacity by ASME or an independent laboratory satisfactory to the Contracting Officer. In no case shall total rated BTU relieving capacity of temperature relief valve, or valves, be less than BTU input into water heater. Temperature relief valve shall be completely open before temperature reaches 98°C (210°F) and shall close when temperature goes below 93°C (200°F).

Pressure relief valves shall conform to requirements of ASME, Section IV. BTU relieving capacity of pressure relief valve, or valves, shall be not less than BTU input of the water heater. The pressure relief shall be set at 690 kPa (100 psig) pressure.

D. A double solenoid safety system shall be provided for each shell and steam coil heater to function as a safety over temperature prevention system. System shall consist of aquastat, pilot light, solenoid steam safety valve and solenoid water safety valve located in the control circuit. The aquastat shall be set at 60°C (140°F).

2.4 DOMESTIC HOT WATER COMPRESSION TANKS

A steel pressure rated tank constructed with welded joints and factory installed butyl rubber diaphragm shall be installed as scheduled. The air pre-charge shall be set to minimum system operating pressure at tank.

The tappings shall be factory fabricated steel, welded to the tank and include ASME B1.20.1 pipe thread.

The interior finish shall comply with NSF 61 barrier materials for potable water tank linings and the liner shall extend into and through the tank fittings and outlets.

The air charging valve shall be factory installed.

2.5 HEAT TRAPS

A. Heat traps shall be installed in accordance with ASHRAE 90.1, latest edition.

2.6 COMBINATION TEMPERATURE AND PRESSURE RELIEF VALVES

A. The combination temperature and pressure relief valves shall be ASME rated and stamped and include a relieving capacity at least as great as the heat input and include a pressure setting less than the water heater's working pressure rating.

PART 3 - EXECUTION

3.1 INSTALLATION:

The water heaters shall be installed on concrete bases. Refer to Specification Section 03 30 00, CAST-IN-PLACE CONCRETE and Section 22 05 11, COMMON WORK RESULTS FOR PLUMBING

The water heaters shall be installed level and plumb.

Water heaters shall be installed and connected in accordance with manufacturer's written instructions.

All pressure and temperature relief valves discharge shall be pipe to nearby floor drains.

Thermometers shall be installed on water heater inlet and outlet piping.

The control thermostats shall be set for a maximum setting of 54°C (130°F).

3.2 LEAKAGE TEST:

- A. Before piping connections are made, the water heaters shall be tested at a hydrostatic pressure of 1375 kPa (200 psi) for water heaters rated at less than 1103 kPa (160 psig) and 1654 kPa (240 psig) for units with an maximum working pressure of 1103 kPa (160 psig) or over. Any failed test shall be corrected and the water heater shall be retested at no additional cost to the VA.

3.3 PERFORMANCE TEST:

- A. Ensure that all of the remote water outlets will have a minimum of 49°C (120°F) and a maximum of 54°C (130°F) water flow at all times. If necessary, make all correction to balance the return water system or reset the thermostat to make the system comply with design requirements.

- - - E N D - - -

SECTION 22 40 00 PLUMBING
FIXTURES

PART 1 - GENERAL

1.1 DESCRIPTION

Plumbing fixtures, associated trim and fittings necessary to make a complete installation from wall or floor connections to rough piping, and certain accessories.

1.2 RELATED WORK

Sealing between fixtures and other finish surfaces: Section 07 92 00, JOINT SEALANTS.

Flush panel access doors: Section 08 31 13, ACCESS DOORS AND FRAMES.

Through bolts: Section 10 21 13, TOILET COMPARTMENTS.

Section 22 05 11, COMMON WORK RESULTS FOR PLUMBING.

1.3 SUBMITTALS

Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

Submit plumbing fixture information in an assembled brochure, showing cuts and full detailed description of each fixture.

1.4 APPLICABLE PUBLICATIONS

The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.

American National Standard Institute (ANSI): The

American Society of Mechanical Engineers (ASME):

A112.6.1M-02(R2008)Floor Affixed Supports for Off-the-Floor
Plumbing Fixtures for Public Use

A112.19.1M-08Enameled Cast Iron Plumbing Fixtures

A112.19.2M-03Vitreous China Plumbing Fixtures

A112.19.3-2001(R2008) .Stainless Steel Plumbing Fixtures (Designed for
Residential Use)

American Society for Testing and Materials (ASTM):

A276-2010 Stainless and Heat-Resisting Steel Bars and
Shapes

WW-P-541-E/GENPlumbing Fixtures with Amendment 1

National Association of Architectural Metal Manufacturers (NAAMM): NAAMM
AMP 500-505

Metal Finishes Manual (1988)

American Society of Sanitary Engineers (ASSE):

1016-05Performance Requirements for Individual
Thermostatic, Pressure Balancing and
Combination Pressure Balancing and Thermostatic
Control Valves for Individual Fixture Fittings

National Sanitation Foundation (NSF)/American National Standards
Institute (ANSI):

61-2009Drinking Water System Components-Health Effects
American with Disabilities Act (A.D.A) Section 4-19.4 Exposed Pipes and
Surfaces

Environmental Protection Agency EPA PL 93-523 1974; A 1999) Safe
Drinking Water Act.

International Building Code, ICC IPBC 2009.

PART 2 - PRODUCTS

2.1 STAINLESS STEEL

A. Corrosion-resistant Steel (CRS):

Plate, Sheet and Strip: CRS flat products shall conform to chemical
composition requirements of any 300 series steel specified in ASTM
A276.

Finish: Exposed surfaces shall have standard polish (ground and
polished) equal to NAAMM finish Number 4.

B. Die-cast zinc alloy products are prohibited.

2.2 STOPS

Provide lock-shield loose key or screw driver pattern angle stops,
straight stops or stops integral with faucet, with each compression
type faucet whether specifically called for or not, including sinks in
wood and metal casework, laboratory furniture and pharmacy furniture.
Locate stops centrally above or below fixture in accessible location.

Furnish keys for lock shield stops to Resident Engineer.

Supply from stops not integral with faucet shall be chrome plated copper
flexible tubing or flexible stainless steel with inner core of non-
toxic polymer.

Supply pipe from wall to valve stop shall be rigid threaded IPS copper
alloy pipe, i.e. red brass pipe nipple, chrome plated where exposed.

Psychiatric Area: Provide stainless steel drain guard for all lavatories
not installed in casework.

2.3 ESCUTCHEONS

Heavy type, chrome plated, with set screws. Provide for piping serving plumbing fixtures and at each wall, ceiling and floor penetrations in exposed finished locations and within cabinets and millwork.

2.4 LAMINAR FLOW CONTROL DEVICE

Smooth, bright stainless steel or satin finish, chrome plated metal laminar flow device shall provide non-aeration, clear, coherent laminar flow that will not splash in basin. Device shall also have a flow control restrictor and have vandal resistant housing.

Flow Control Restrictor:

Capable of restricting flow from 95 ml/s to 110 ml/s (1.5 gpm to 1.7 gpm) for lavatories; 125 ml/s to 140 ml/s (2.0 gpm to 2.2 gpm) for sinks P-505 through P-520, P-524 and P-528; and 170 ml/s to 190 ml/s (2.75 gpm to 3.0 gpm) for dietary food preparation and rinse sinks or as specified.

Compensates for pressure fluctuation maintaining flow rate specified above within 10 percent between 170 kPa and 550 kPa (25 psi and 80 psi).

Operates by expansion and contraction, eliminates mineral/sediment build-up with self-cleaning action, and is capable of easy manual cleaning.

2.5 CARRIERS

ASME/ANSI A112.6.1M, with adjustable gasket faceplate chair carriers for wall hung closets with auxiliary anchor foot assembly, hanger rod support feet, and rear anchor tie down.

ASME/ANSI A112.6.1M, lavatory, chair carrier for thin wall construction. All lavatory chair carriers shall be capable of supporting the lavatory with a 250-pound vertical load applied at the front of the fixture.

Where water closets, lavatories or sinks are installed back-to-back and carriers are specified, provide one carrier to serve both fixtures in lieu of individual carriers. The drainage fitting of the back to back carrier shall be so constructed that it prevents the discharge from one fixture from flowing into the opposite fixture.

2.6 WATER CLOSETS

A. (P-101) Water Closet (Floor Mounted, ANSI 112.19.2M, Figure 6) - office and industrial, elongated bowl, siphon jet 6 L (1.6 gallons) per flush, floor outlet. Top of rim shall be 435 mm to 438 mm (17 1/8 inches to 17 1/4 inches) above finished floor.

Seat: Institutional/Industrial, extra heavy duty, chemical resistant, solid plastic, open front less cover for elongated bowls, integrally molded bumpers, concealed check hinge with stainless steel post. Seat shall be posture contoured body design. Color shall be white.

Fittings and Accessories: Floor flange fittings-cast iron; Gasket-wax; bolts with chromium plated cap nuts and washers.

Flush valve: Large chloramines resistant diaphragm, semi-red brass valve body, exposed chrome plated, battery powered active infra-red sensor for automatic operation with courtesy flush button for manual operation, water saver design 6 L (1.6 gallons) per flush with maximum 10 percent variance, top spud connection, adjustable tailpiece, one-inch IPS screwdriver back check angle stop with vandal resistant cap, high back pressure vacuum breaker, and sweat solder adapter with cover tube and cast set screw wall flange. Set centerline of inlet 292 mm (11 1/2 inches) above rim. Seat bumpers shall be integral part of flush valve. Valve body, cover, tailpiece and control stop shall be in conformance with ASTM Alloy classification for semi-red brass.

2.7 BATHTUBS

A. (P-301) Bathtub, free standing type hydro massage bathtub with wall mounted mixing valve, separate fill and shower control valves and drain will be furnished by the Owner.

Provide rough-in and final waste and water connections including installation of accessories supplied with the fixture.

Prior to starting work, obtain from the Owner, the manufacturers' written installation instruction for the bathtub being installed. 2.8

LAVATORIES

Dimensions for lavatories are specified, Length by width (distance from wall) and depth.

Brass components in contact with water shall contain no more than 3 percent lead content by dry weight.

(P-401) Lavatory (Lorist Control). Sink shall be integral to countertop.

1. Faucet: Solid cast brass construction with washerless ceramic disc mixing cartridge type and integral 102 mm (4") cast spout with outlet 51-76 mm (2-3 inches) above rim. Provide laminar flow control device. One hundred millimeters (4 inches) wrist handles on faucets shall be cast, formed or drop forged copper alloy. Faucet, wall and floor escutcheons shall be either copper alloy or CRS. Exposed metal parts,

including exposed part under valve handle when in open position, shall have a smooth bright finish.

Drain: Cast or wrought brass with flat grid strainer and offset tailpiece, chrome plated finish.

Stops: Angle type, See paragraph 2.2. Stops

Trap: Cast copper alloy, 38 mm by 32 mm (1 1/2 inches by 1 1/4 inches) P-trap. Adjustable with connected elbow and 1.4 mm thick (17 gauge) tubing extensions to wall. Exposed metal trap surfaces and connection hardware shall be chrome plated with a smooth bright finish. Set trap parallel to wall.

Provide cover for drain, stops and trap per A.D.A 4-19.4.

- D. (P-415) Lavatory (Lorist Control, straight back, approximately 508 mm by 457 mm (20 inches by 18 inches) and a 102 mm (4 inches) minimum apron, first quality vitreous china. Punching for faucet on four-inch centers. Set rim 864 mm (34 inches) above finished floor.

Faucet: Solid cast brass construction with washerless ceramic disc mixing cartridge type and integral 102 mm (4") cast spout with outlet 51-76 mm (2-3 inches) above rim. Provide laminar flow control device. One hundred millimeters (4 inches) wrist handles on faucets shall be cast, formed or drop forged copper alloy. Faucet, wall and floor escutcheons shall be either copper alloy or CRS. Exposed metal parts, including exposed part under valve handle when in open position, shall have a smooth bright finish.

Drain: Cast or wrought brass with flat grid strainer, offset tailpiece, brass, chrome plated.

Stops: Angle type. See paragraph 2.2. Stops

Trap: Cast copper alloy, 38 mm by 32 mm (1 1/2 inches by 1 1/4 inches) P-trap. Adjustable with connected elbow and 1.4 mm thick (17 gauge) tubing extension to wall. Exposed metal trap surface and connection hardware shall be chrome plated with a smooth bright finish. Set trap parallel to the wall. Set trap parallel to wall.

Provide cover for drain, stops and trap per A.D.A 4-19.4.

2.9 SINKS AND LAUNDRY TUBS

Dimensions for sinks and laundry tubs are specified, length by width (distance from wall) and depth.

- (P-502) Service Sink (Corner, Floor Mounted) stain resistant terrazzo, 711 mm by 711 mm by 305 mm (28 inches by 28 inches by 12 inches) with 152 mm (6 inches) drop front. Terrazzo, composed of marble chips and white Portland cement, shall develop compressive strength of 20684 kPa (3000 psi) seven days after casting. Provide extruded aluminum cap on front side.

1. Faucet: Solid brass construction, combination faucet with replaceable monel seat, removable replacement unit containing all parts subject to wear, integral stops, mounted on wall above sink. Spout shall have

a pail hook, 19 mm (3/4 inch) hose coupling threads, vacuum breaker, and top or bottom brace to wall. Four-arm handles on faucets shall be cast, formed, or drop forged copper alloy. Escutcheons shall be either forged copper alloy or CRS. Exposed metal parts, including exposed part under valve handle when in open position, shall have a smooth bright finish. Provide 914 mm (36 inches) hose with wall hook.

Centerline of rough in is 1219 mm (48 inches) above finished floor.

Drain: Seventy six millimeter (3 inches) cast brass drain with nickel bronze strainer.

Trap: P-trap, drain through floor.

- C. (P-521) Laundry Tub (Plastic, Single Compartment with Legs) fiber reinforced plastic, single bowl with raised back, approximately 635 mm by 559 mm (25 inches by 22 inches) by 356 mm (14 inches) deep, with base and legs.

Faucets: Solid brass construction, combination faucet with replacement monel seat, removable replacement unit containing all parts subject to wear, vacuum breaker, integral stops, mounted on splash back. Lever handles on faucet shall be cast, formed or drop forged copper alloy or CRS. Exposed metal parts, including exposed part under valve handle when in open position, shall have a smooth bright finish.

Drain: Stopper.

Trap: Cast copper alloy, 38 mm (1 1/2 inches) P-trap. Adjustable with connected elbow, and nipple to wall and escutcheon.

- D. (P-528) Sink (CRS, Single Compartment, Counter Top ASME/ANSI A112.19.2M, Kitchen Sinks, Figure 5) self rimming, back faucet ledge, approximately 533 mm by 559 mm (21 inches by 22 inches) with single compartment inside dimensions approximately 406 mm by 483 mm by 191 mm (16 inches by 19 inches by 7 1/2 inches) deep. Shall be minimum of 1.3 mm thick (18 gauge) CRS. Corners and edges shall be well rounded:

Faucet: Solid brass construction, deck mounted combination faucet with monel or ceramic seats, removable replacement unit containing all parts subject to wear, swivel gooseneck spout with approximately 203 mm (8 inches) reach with spout outlet 152 mm (6 inches) above deck and single lever with hose spray. Faucet shall be polished chrome plated.

Drain: Drain plug with cup strainer, stainless steel.

Trap: Cast copper alloy 38 mm (1 1/2 inches) P-trap with cleanout plug. Provide wall connection and escutcheon.

Provide cover for drain, stops and trap per A.D.A 4-19.4.

2.10 DISPENSER, DRINKING WATER

Standard rating conditions: 10 degrees C (50 degrees F) water with 27 degrees C (80 degrees F) inlet water temperature and 32 degrees C (90 degrees F) ambient air temperature.

(P-609) Electric Water Cooler: Mechanically cooled, self contained, wheel chair, bubbler style fully exposed dual height stainless steel fountain, recessed in wall refrigeration system, stainless steel grille, stainless steel support arm, wall mounting box, energy efficient cooling system consisting of a hermetically sealed reciprocating type compressor, 115v, 60 Hz, single phase, fan cooled condenser, permanently lubricated fan motor. Set highest bubbler 1016 mm (40 inches) above finished floor.

2.11 SHOWER BATH FIXTURE

A. (P-701) Shower Bath Fixture (Detachable, Wall Mounted, Concealed Supplies, Type T/P Combination Valve):

Shower Installation: Wall mounted detachable spray assembly, 600 mm (24 inch) wall bar, elevated vacuum breaker, supply elbow and flange and valve. All external trim, chrome plated metal.

Shower Head Assembly: Plastic shower head with flow control to limit discharge to 160 ml/s (2.5 gpm), 1524 mm (60 inches) length of rubber lined CRS, chrome plated metal flexible, or white vinyl reinforced hose and supply wall elbow. Design showerhead to fit in palm of hand. Provide CRS or chrome plated metal wall bar with an adjustable swivel hanger for showerhead. Fasten wall bar securely to wall for hand support.

Valves: Type T/P combination thermostatic and pressure balancing, with chrome plated metal lever type operating handle adjustable for rough-in variations and chrome plated metal or CRS face plate. Valve body shall be any suitable copper alloy. Internal parts shall be copper, nickel alloy, CRS or thermoplastic material. Valve inlet and outlet shall be 13 mm (1/2 inch) IPS. Provide external screwdriver check stops, vacuum breaker and temperature limit stops. Set stops for a maximum temperature of 40 degrees C (105 degrees F). All exposed fasteners shall be vandal resistant. Valve shall provide a minimum of 160 ml/s at 310 kPa (2.5 gpm at 45 psi) pressure drop.

2.12 HYDRANT, HOSE BIBB AND MISCELLANEOUS DEVICES

(P-801) Wall Hydrant: Cast bronze non-freeze hydrant with detachable T-handle. Brass operating rod within casing of bronze pipe of sufficient length to extend through wall and place valve inside building. Brass valve with coupling and union elbow having metal-to-metal seat. Valve rod and seat washer removable through face of hydrant; 19 mm (3/4 inch) hose thread on spout; 19 mm (3/4 inch) pipe thread on inlet. Finish may be rough; exposed surfaces shall be chrome plated. Set not less than 457 mm (18 inches) nor more than 914 mm (36 inches) above grade. On porches and platforms, set approximately 762 mm (30 inches) above finished floor. Provide integral vacuum breaker which automatically drains when shut off.

(P-808) Washing Machine Supply and Drain Units: Fabricate of 16-gage steel with highly corrosion resistant epoxy finish. Unit to have 51 mm (2 inches) drain connection, 13 mm (1/2 inch) combination MPT brass sweat connection, ball type shut-off valve, 51 mm (2 inches) cast brass P-trap, duplex electric grounding receptacle and dryer outlet. Size 229 mm by 375 mm (9 inches by 14 3/4 inches) rough wall opening 203 mm by 330 mm by 92 mm (8 inches by 13 inches by 3 5/8 inches). Centerline of box shall be 1118 mm (44 inches) above finished floor.

PART 3 - EXECUTION

3.1 INSTALLATION

Fixture Setting: Opening between fixture and floor and wall finish shall be sealed as specified under Section 07 92 00, JOINT SEALANTS.

Supports and Fastening: Secure all fixtures, equipment and trimmings to partitions, walls and related finish surfaces. Exposed heads of bolts and nuts in finished rooms shall be hexagonal, polished chrome plated brass with rounded tops.

Through Bolts: For free standing marble and metal stud partitions refer to Section 10 21 13, TOILET COMPARTMENTS.

Toggle Bolts: For hollow masonry units, finished or unfinished.

Expansion Bolts: For brick or concrete or other solid masonry. Shall be 6 mm (1/4 inch) diameter bolts, and to extend at least 76 mm (3 inches) into masonry and be fitted with loose tubing or sleeves extending into masonry. Wood plugs, fiber plugs, lead or other soft metal shields are prohibited.

Power Set Fasteners: May be used for concrete walls, shall be 6 mm (1/4 inch) threaded studs, and shall extend at least 32 mm (1 1/4 inches) into wall.

Tightly cover and protect fixtures and equipment against dirt, water and chemical or mechanical injury.

Where water closet waste pipe has to be offset due to beam interference, provide correct and additional piping necessary to eliminate relocation of water closet.

Do not use aerators on lavatories and sinks.

3.2 CLEANING

At completion of all work, fixtures, exposed materials and equipment shall be thoroughly cleaned.

- - - E N D - - -

THIS PAGE INTENTIONALLY LEFT BLANK

SECTION 22 63 00
GAS SYSTEMS FOR LABORATORY AND HEALTHCARE FACILITIES

PART 1 - GENERAL

1.1 DESCRIPTION

Central Laboratory and Healthcare Gas Systems: Consisting of oxygen, complete, ready for operation, including all necessary piping, fittings, valves, cabinets, station outlets, rough-ins, gages, alarms including low voltage wiring, air dryers, filters, pressure regulators, dew point, and all necessary parts, accessories, connections and equipment.

Oxygen System: Ready for connection to outside bulk supply tank, but not including tank.

Supply Lines Outside of Building (including PVC protective pipe): As specified in this Section.

Laboratory and healthcare gas system alarm wiring from equipment to alarm panels.

1.2 RELATED WORK

Sealing around pipe penetrations to maintain the integrity of time rated construction: Section 07 84 00, FIRESTOPPING.

Sealing around pipe penetrations through the floor to prevent moisture migration: Section 07 92 00, JOINT SEALANTS.

General requirements and items common to more than one section of Division 22. Section 22 05 11, COMMON WORK RESULTS FOR PLUMBING.

Alarm interface with ECC. Section 23 09 23, DIRECT-DIGITAL CONTROL SYSTEM FOR HVAC.

Conduit: Section 26 05 33, RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS.

Control wiring: Section 26 05 21, LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES (600 VOLTS AND BELOW).

Electrical wiring and accessories: Section 26 27 26, WIRING DEVICES.

Electric motors: Section 22 05 12, GENERAL MOTOR REQUIREMENTS FOR PLUMBING EQUIPMENT.

Motor starters: Section 26 29 11, LOW-VOLTAGE MOTOR STARTERS.

Prefabricated bedside patient units: Section 10 25 13, PATIENT BED SERVICE WALLS. **1.3 QUALITY ASSURANCE**

Materials and Installation: In accordance with NFPA 99, (2005) and as specified.

Equipment Installer: Show technical qualifications and previous experience in installing laboratory and healthcare equipment on three

similar projects. Submit names and addresses of referenced projects. Installers shall meet the qualifications of ANSI/ASSE Standard 6010.

Equipment Supplier: Show evidence of equivalent product installed at three installations similar to this project that has been in satisfactory and efficient operation for three years. Submit names and addresses where the product is installed.

Laboratory and healthcare System Testing Organization: The testing shall be conducted by a party technically competent and experienced in the field of laboratory and healthcare pipeline testing. Testing and systems verification shall be performed by personnel meeting the qualifications of ANSI/ASSE Standard 6030. Such testing shall be performed by a party other than the installing contractor.

Provide names of three projects where testing of medical or laboratory gases systems has been performed by the testing agency. Include the name of the project, names of such persons at that project who supervised the work for the project owner, or who accepted the report for the project owner, and a written statement that the projects listed required work of similar scope to that set forth in this specification.

Submit the testing agency's detailed procedure which will be followed in the testing of this project. Include details of the testing sequence, procedures for cross connection tests, outlet function tests, alarm tests, purity tests, etc., as required by this specification. For purity test procedures, include data on test methods, types of equipment to be used, calibration sources and method references.

Certification: Provide documentation prior to submitting request for final inspection to include all test results, the names of individuals performing work for the testing agency on this project, detailed procedures followed for all tests, and a certification that all results of tests were within limits allowed by this specification.

Installing contractor shall maintain as-built drawings of each completed phases for verification; and, shall provide the complete set at the time of final systems certification testing, for certification by the Third Party Testing Company. As-built drawings shall be provided on prints and in digital format. The digital format shall be in the native CAD system required for the project design. Should the installing contractor engage the testing company to provide as-built or any portion thereof, it shall not be deemed a conflict of interest or breach of the 'third party testing company' requirement.

1.4 SUBMITTALS

- A. Submit as one package in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Manufacturer's Literature and Data:
- Piping.
 - Valves.
 - Inlet and outlet cocks
 - Valve cabinets.
 - Gages.
 - Station outlets and rough-in assemblies.
 - Ceiling services.
 - Alarm controls and panels.
 - Pressure Switches.
 - Manifolds.
- C. Station Outlets: Submit letter from manufacturer stating that outlets are designed and manufactured to comply with NFPA 99. Outlet shall bear label of approval as an assembly, of Underwriters Laboratories, Inc., or Associated Factory Mutual Research Corporation. In lieu of above labels, certificate may be submitted by a nationally recognized independent testing laboratory, satisfactory to the Contracting Officer, certifying that materials, appliances and assemblies conform to published standards, including methods of tests, of above organizations.
- D. Certification: The completed systems have been installed, tested, purged, analyzed and verified in accordance with the requirements of this specification.

1.5 TRAINING

Furnish the services of a competent instructor for not less than two four-hour periods for instructing personnel in the operation and maintenance of the laboratory and healthcare gas systems, on the dates requested by COTR.

Coordinate with other requirements specified in Section 01 00 00, GENERAL REQUIREMENTS. **1.6 APPLICABLE**

PUBLICATIONS

The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the test by the basic designation only.

American Society for Testing and Materials (ASTM):

B819-(R2006) Seamless Copper Tube for Medical Gas Systems

American Society of Mechanical Engineers (ASME):

- A13.1-07 Scheme for Identification of Piping Systems
- B16.22-01(R2005)Wrought Copper and Bronze Solder-Joint Pressure Fittings
- B40.100 (2005) Pressure Gauges and Gauge Attachments Boiler and Pressure Vessel Code -
- Section VIII-07Pressure Vessels, Division I
- Section IX-07Welding and Brazing Qualifications
- American Welding Society (AWS):
- AWS A5.8-04Brazing Filler Metal
- AWS B2.2-91 Standard for Brazing Procedure and Performance Qualification (Modified per NFPA 99)
- Compressed Gas Association (CGA):
- C-9-04 Standard Color Marking of Compressed Gas Cylinders
- G-4.1 (2009) Cleaning Equipment for Oxygen Service
- G-10.1(2008)Nitrogen, Commodity
- P-9-01 Inert Gases Argon, Nitrogen and Helium
- V-1-05Standard for Compressed Gas Cylinder Valve Outlet and Inlet Connections
- National Electrical Manufacturers Association (NEMA):
- ICS-6-93(R2006) Industrial Controls and Systems Enclosures
- National Fire Protection Association (NFPA):
- 99-05Health Care Facilities
- United States Pharmacopoeia XXI/National Formulary XVI (USP/NF)
- Manufacturing Standardization Society (MSS):
- MSS-SP-72-99 Ball Valves With Flanged or Butt Welding For General Purpose
- MSS-SP-110-96 Ball Valve Threaded, Socket Welding, Solder Joint, Grooved and Flared Ends
- MSS-SP-73-03 Brazing Joints for Copper and Copper Alloy Solder Pressure Fittings

PART 2 - PRODUCTS

2.1 PIPING AND FITTINGS

- A. Copper Tubing: Type "K", ASTM B819, seamless copper tube, hard drawn temper, with wrought copper fittings conforming to ASME B16.22 or brazing fittings complying with MSS SP-73. Size designated reflecting nominal inside diameter. All tubing and fittings shall be labeled "OXY"

Brazing Alloy: AWS A5.8, Classification BCuP, greater than 537 °C (1000 °F) melting temperature. Flux is strictly prohibited for copper-to-copper connections.

Screw Joints: Polytetrafluoroethylene (teflon) tape.

Underground Protective Pipe: Polyvinyl Chloride (PVC), ASTM D1785, Schedule 80.

Memory metal couplings: Temperature and pressure rating shall not be less than that of a brazed joint.

Apply piping identification labels at the time of installation in accordance with current NFPA. Apply supplementary color identification in accordance with CGA Pamphlet C-9.

Special Fittings: The following special fittings shall be permitted to be used in lieu of brazed joints:

Memory-metal couplings having temperature and pressure ratings joints not less than that of a brazed joint.

Listed or approved metallic gas tube fittings that, when made up, provide a permanent joint having the mechanical, thermal, and sealing integrity of a brazed joint.

Dielectric fittings where required by the manufacturer of special medical equipment to electrically isolate the equipment from the piping distribution system.

Axially swaged, elastic strain preload fittings providing metal to metal seal having pressure and temperature ratings not less than that of a brazed joint and when complete are permanent and non-separable.

2.2 EXPOSED LABORATORY AND HEALTHCARE GASES PIPING

A. Finished Room: Use full iron pipe size chrome plated brass piping for exposed laboratory and healthcare gas piping connecting fixtures, casework, cabinets, equipment and reagent racks when not concealed by apron including those furnished by the Government or specified in other sections.

Pipe: Fed. Spec. WW-P-351, standard weight.

Fittings: ASME B16.15 cast bronze threaded fittings with chrome finish, (125 and 250 PS1 Classes).

Nipples: ASTM B 687, Chromium-plated.

Unions: Mss SP-72, SP-110, Brass or Bronze with chrome finish. Unions 65 mm (2-1/2 inches) and larger shall be flange type with approved gaskets.

Valves: Mss SP-72, SP-110, Brass or bronze with chrome finish.

2.3 VALVES

A. Ball: In-line, other than zone valves in cabinets:

Seventy five millimeter (2 1/2 inches) and smaller: Bronze/ brass body, Fed. Spec. MSS SP72 & SP 110 , Type II, Class 150, Style 1, with tubing extensions for brazed connections, full port, three-piece or double union end connections, teflon seat seals, full flow, 4125 kPa (600 psi) WOG minimum working pressure, with locking type handle, cleaned for oxygen use and labeled for intended service

Eighty to one hundred millimeter (3-4 inches): Bronze/ brass body, Fed. Spec. MSS SP72 & SP 110, Type II, Class 150, Style 1 with tubing extensions brazed to flanges, full ported, three piece, double seal, teflon seals, full flow, 4125 kPa (600 psi) WOG minimum working pressure, with locking type handle, cleaned for oxygen use and labeled for intended service.

B. Check:

Eighty millimeter (3 inches) and smaller: Bronze/brass body, straight through design for minimum pressure drop, spring loaded, self aligning with teflon cone seat, vibration free, silent operation, supplied NPT female threads at each end with flow direction arrow permanently cast into, cleaned for oxygen use and labeled for intended service, 2750 kPa (400 psi) WOG minimum working pressure.

One hundred millimeter (4 inches) and larger: Iron body, bronze trim, swing type, vertical or horizontal installation, flange connection, with flow direction arrow permanently cast into, cleaned for oxygen use and labeled for intended service, 1025 kPa (150 psi) WSP.

C. Zone Valve in Cabinet: Ball valve, bronze/ brass body, double seal, three piece or double union end connections, replaceable teflon seat seals, teflon stem seal, 4125 kPa (600 psi) WOG, cold, non-shock gas working pressure service to 100 kPa (29 inch Hg), cleaned for oxygen use and labeled for intended service, blowout proof stem, one quarter turn of handle to completely open or close. Provide tubing extensions factory brazed, and pressure tested. Provide 3 mm (1/8 inch) NPT gauge port for a 50mm (2 inch) diameter monitoring gauge downstream of the shut off valve. Zone valves shall be securely attached to the cabinet and provided with type-K copper tube extensions for making connection to system piping outside the cabinet. Zone valves shall be products of one manufacturer, and uniform throughout in pattern, overall size and appearance. Trim with color coded plastic inserts or color coded

stick-on labels. Install valves in cabinets such that cover window cannot be in place when any valve is in the closed position. Color coding for identification plates and labels is as follows:

SERVICE LABEL	IDENTIFICATION COLORS	MFG. STD. CLR.
OXYGEN	White letters on green background	GREEN

2.4 VALVE CABINETS

Flush mounted commercially available item for use with laboratory and healthcare services, not lighter than 1.3 mm (18 gage) steel or 1.9 mm (14 gage) extruded aluminum, rigidly assembled, of adequate size to accommodate valve(s) and fittings. Punch or drill sides to receive tubing. Provide anchors to secure cabinet to wall construction. Seal openings in cabinet to be dust tight. Locate bottom of cabinet 1375 mm (4 foot 6 inches) above floor.

Mount engraved rigid plastic identification plate on wall above or adjacent to cabinet. Color code identification plate to match gas identification colors as indicated above. Identification plate must be clearly visible at all times. Provide inscriptions on plate to read in substance: "VALVE CONTROL SUPPLY TO ROOMS."

Cover plate: Fabricate from 1.3 mm (18 gage) sheet metal with satin chromed finish, extruded anodized aluminum, or .85 mm (22 gage) stainless steel. Provide cover window of replaceable plastic, with a corrosion resistant device or lever secured to window for emergency window removal. Permanently paint or stencil on window: CAUTION-CLOSE ONLY IN EMERGENCY, SHUT-OFF VALVES FOR PIPED GASES", or equivalent wording. Configure such that it is not possible to install window with any valve in the closed position. Each valve shall have gauge upstream of valve inside valve box.

Cabinets and isolation valves shall be located and piped as shown, and at a minimum, so as to allow the isolation of each smoke compartment separately. No cabinet shall serve more than one smoke compartment.

2.5 GAGES

A. Pressure Gages: Includes gages temporarily supplied for testing purposes.

1. For line pressure use adjacent to source equipment: ASME B40.1, pressure gage, single, size 115 mm (4-1/2 inches), for compressed air, nitrogen and oxygen, accurate to within two percent, with metal case. Range shall be two times operating pressure. Dial graduations

- and figures shall be black on a white background, or white on a black background. Gage shall be cleaned for oxygen use, labeled for appropriate service, and marked "USE NO OIL". Install with gage cock.
2. For all services downstream of main shutoff valve: Manufactured for oxygen use, labeled for the appropriate service and marked "USE NO OIL", 40 mm (1-1/2 inch) diameter gage with dial range 1-690 kPa (1-100 psi) for air service.

2.6 STATION OUTLETS

For all services except ceiling hose drops: For designated service, consisting of a quick coupler and inlet supply tube. Provide coupler that is non-interchangeable with other services, and leak proof under three times the normal working pressure. Equip each station outlet with an automatic valve and a secondary check valve to conform with NFPA 99. Equip each station inlet with an automatic valve to conform with NFPA 99. Place valves in the assembly to provide easy access after installation for servicing and replacement, and to facilitate line blowout, purging, and testing. Fasten each outlet and inlet securely to rough-in to prevent floating and provide each with a capped stub length of 6 mm (1/4-inch) (10 mm outside diameter) (3/8-inch outside diameter) tubing for connection to supply. Identification of each gas service shall be permanently cast into the back plate and shall be visible through a transparent plastic guard. Label stub tubing for appropriate service. Rough-in kits and test plugs for Prefabricated Bedside Patient Units (PBPU) are furnished under this specification but installed by manufacturer of PBPU's before initial test specified herein. Install completion kits (valve body and face plate) for the remainder of required tests.

For Ceiling Hose Drops: Brass, stainless steel or chromed metal non-interchangeable DISS connections for appropriate service to conform with CGA V-5. Equip each station outlet with an automatic valve and a secondary check valve to conform with NFPA 99. Equip each station inlet with an automatic valve to conform with NFPA 99. Place valves in the assembly to provide easy access after installation, for servicing and replacement, and to facilitate line blow-out, purging, and testing. Fasten each outlet and inlet securely to rough-in to prevent floating, and provide each with a capped stub length of 6 mm (1/4-inch) (10 mm (3/8-inch) outside diameter) tubing for connection to supply. Label stub tubing for appropriate service. Adjust to compensate for variations in plaster or cover thickness.

2.7 STATION OUTLETS

For all services: Brass, stainless steel or chromed metal non-interchangeable DISS connections for appropriate service to conform with CGA V-5. Equip each station outlet with an automatic valve and a secondary check valve to conform with NFPA 99. Equip each station inlet with an automatic valve to conform with NFPA 99. Place valves in the assembly to provide easy access after installation, for servicing and replacement, and to facilitate line blow-out, purging, and testing. Fasten each outlet securely to outlet rough-in to prevent floating, and provide each outlet with a capped stub length of 6 mm (1/4-inch) (10 mm (3/8-inch) outside diameter) tubing for connection to supply. Label stub tubing for appropriate service. Adjustable to compensate for variations in plaster or cover thickness. Rough-in kits and test plugs for Prefabricated Bedside Patient Units (PBPUs) are furnished under this specification but installed by manufacturer of PBPUs before initial tests specified herein. Install outlet completion kits (valve body and face plate) for the remainder of required tests.

2.8 STATION OUTLET ROUGH-IN

Flush mounted, protected against corrosion. Anchor rough-in securely to unit or wall construction.

Modular Cover Plate: Die cast back plate, two-piece .85 mm (22 gage) stainless steel or 1.6 mm (16 gage) chromium plated metal, with mounting flanges on all four sides, secured to rough-in with stainless steel or chromium plated countersunk screws.

Cover Plate for Prefabricated Bedside Patient Units (PBPUs): One-piece with construction and material as indicated for modular cover plate.

Provide permanent, metal or plastic, identification plates securely fastened at each outlet and inlet opening, with inscription for appropriate service using color coded letters and background. Metal plates shall have letters embossed on baked-on enamel background. Color coding for identification plates is as follows:

SERVICE LABEL	IDENTIFICATION PLATE COLORS
OXYGEN	White letters on green background

Ceiling Mounted Station Outlets: As specified under Article, STATION OUTLETS, flush mount on ceiling and provide with hose tubing drops and retractors. Extend male thread DISS connection through ceiling plate.

- Hoses: Conductive, neoprene tubing, color coded for appropriate service, dropping to within 1372 mm (4 feet 6 inches) from floor,

with upper end of hose having female DISS connection with nut, easily finger tightened to ceiling outlet or inlet, and lower end of hose having DISS connection only for nitrogen service, and having quick coupler for all other services. Color coding for hoses is as follows:

SERVICE	HOSE COLOR
OXYGEN	Green

Rough-in: Standard metal single gang, interchangeable, sectional or one piece, securely anchored to ceiling runner channels; ceiling plates of die cast plate, .85 mm (22 gage) stainless steel or 1.6 mm (16 gage) chromium plated metal. Attach identification plate, as specified in Article, STATION OUTLET AND INLET ROUGH-IN, to ceiling plate adjacent to each outlet and inlet.

Hose retractor kit: Chrome-plated, spring loaded assembly and hose clamps with stainless steel sash chain; to automatically withdraw hose assembly a minimum of 508 mm (20-inches) from fully extended position of 1425 mm (4 feet 8 inches) to 1930 mm (6 feet 4 inches) above finished floor.

2.10 ALARMS

- A. Provide all low voltage control wiring, except for wiring from alarm relay interface control cabinet to ECC, required for complete, proper functioning system, in conformance with Section 26 05 21, LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES (600 VOLTS AND BELOW). Run wiring in conduit, in conformance with Section 26 05 33, RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS.
- B. Master Alarm Functions: Provide the following individual alarms at the master alarm panel.
 1. Oxygen Alarms:
 - Low pressure alarm: Functions when system pressure downstream of the main shutoff valve drops below 275 kPa (40 psi), plus/minus 14 kPa (2 psi); operated by pressure switch or transmitters.
 - High pressure alarm: functions when system pressure downstream of main shutoff valve increases above 415 kPa (60 psi), plus/minus 14 kPa (2 psi) set points; operated by pressure switches or transmitters.
- C. Alarm Functions:
 1. Oxygen alarms: Pressure alarms: Functions when pressure in branch drops below 275 kPa (40 psi), plus/minus 14 kPa (2 psi) or increases above 414 kPa (60 psi), plus/minus 14 kPa (2 psi) set points; operated by pressure switches or transmitters.
- D. Alarm Panels:
 1. General: Modular design, easily serviced and maintained; alarms operate on alternative current low voltage control circuit; provide required number of transformers for efficient functioning of complete system. Alarm panels shall be integral units, reporting as required.

Box: Flush mounted, sectional or one piece, corrosion protected. Size to accommodate required number of service functions for each location, and for one audible signal in each box. Anchor box securely. Provide spare capacity to accommodate 50% of the number of provided alarm points.

Cover plate: Designed to accommodate required number of signals, visual and audible, for each location, and containing adequate operating instructions within the operator's view. Bezel shall be extruded aluminum, chromium plated metal, or plastic. Secure to the box with chromium plated or stainless steel countersunk screws.

Service indicator lights: Red translucent plastic or LED with proper service identification inscribed thereon. Number of lights and service instruction shall be as required for each location. Provide each panel with a green test button of the same material, inscribed with "PUSH TO TEST" or similar message.

Audible signal: Provide one in each alarm panel and connect electrically with all service indicator light functions.

Controls:

Visual signal: When the condition occurs which any individual service indicator light is to report, button for particular service shall give a lighted visual signal which cannot be canceled until such condition is corrected.

Audible signal: Alarm shall give an audible signal upon circuit energization of any visual signal. Audible signal shall be continuous until silenced by pushing a button. This shall cancel and reset audible only, and not affect the visual signal. After silencing, subsequent alarms shall reactivate the audible alarm.

Signal tester: Test button or separate normal light shall be continuously lighted to indicate electrical circuit serving each individual alarm is energized. Pushing test button shall temporarily activate all visual signals and sound audible signal, thereby providing desired indications of status of system.

- E. Alarm Relay Interface Control Cabinet: Design cabinet to transfer the closed circuit alarm signals through relays to a set of terminals for monitoring signals at the ECC without interrupting the closed circuit system. Construct of 1.9 mm (14 gage) steel, conforming with NEMA ICS-6, Type 1, enclosures. Provide both normally open and normally closed contacts for output signals, with number of circuits required for full alarm capability at the ECC. Refer to Section 23 09 23, DIRECT-DIGITAL CONTROL SYSTEM FOR HVAC for compatibility.

F. Alarm Network Communication: Network communications board shall be installed in local alarm and connected to the facility's Ethernet. Local alarm modules shall send information to the master alarm and the data can be downloaded thru the computer connected to the facility's Ethernet. Master alarm displays the message, sound its alarm and saves the information in an event log. This event log shall be downloaded to a computer file for tracking data and troubleshooting.

2.11 PRESSURE SWITCHES

General purpose, contact or mercury type, allowing both high and low pressure set points, with contact type provided with a protective dust cover; adjustable range set by inside or outside adjustment; switches activate when indicated by alarm requirements. Use one orifice nipple (or DISS demand check valve) for each sensor or pressure switch.

2.12 PRESSURE REGULATORS:

- A. For 690 kPa (100 psi) regulator, provide duplex in parallel, valve for maintenance shut-down without service interruption. For additional pressures, locate regulators remote from compressor near point of use, and provide with isolation valves and valve bypass.
 - 1. For systems 5 L/s (10 scfm) and below: Brass or bronze body and trim, reduced pressure range 170 - 850 kPa (25 - 125 psi) adjustable, spring type, diaphragm operated diaphragm operated, relieving. Delivered pressure shall vary not more than one kPa (0.15psi) for each 10 kPa (1.5psi) variation in inlet pressure.

2.13 EMERGENCY LOW PRESSURE OXYGEN INLET

The Low Pressure Emergency Oxygen Inlet provides an inlet for connecting a temporary auxiliary source of oxygen to the oxygen pipeline system for emergency or maintenance situations per NFPA 99.

The inlet consist of a 1" (25 mm) ball valve, pressure gauge and a 1/2"/1" NPTF connection housed in a weather tight enclosure. The enclosure is labeled "Emergency Low Pressure Gaseous Oxygen Inlet", and includes a padlock staple to prevent tampering or unauthorized access. The enclosure is suitable for recess mounting on the exterior of the building being served. The enclosure is 14 gauge, cold rolled steel with a primer coat of paint. The Emergency Oxygen Inlet is connected at a point downstream of the main supply line shutoff valve.

Check valves are provided for installation in the emergency supply line and 'in the main supply line between the main line shutoff valve and the emergency supply line connection per by NFPA 99. Check valves have a cast bronze body and straight through design for minimum pressure drop.

The check valves for sizes under 3" (76 mm) are soft seated, bubble tight, self aligning, and spring loaded, and ball type check valves. Three inch (76 mm) check valves are hard seated, spring loaded, self aligning ball type checks with cone seats (3" valves may not be "bubble tight"). Check valves are fast acting.

A relief valve is provided for installation in the emergency supply line per NFPA 99. The relief valve has a brass body, single seat design, and is cleaned for oxygen use. It automatically reseats to provide a "bubble tight" seal after discharging excess gas. Pre-set at 75 psi.

PART 3 - EXECUTION

3.1 INSTALLATION

In accordance with current NFPA. Run buried oxygen piping in PVC protective pipe for entire length including enclosure of fittings and changes of direction.

Install cast escutcheon with set screw at each wall, floor and ceiling penetration in exposed finished locations and within cabinets and millwork.

Keep open ends of tube capped or plugged at all times or otherwise sealed until final assembly.

Cut piping square and accurately with a tube cutter (sawing not permitted) to measurements determined at place of installation. Ream tube to remove burrs, being careful not to expand tube, and so no chips of copper remain in the tube. Work into place without springing or forcing. Bottom tube in socket so there are no gaps between tube and fitting. Exercise care in handling equipment and tools used in cutting or reaming of tube to prevent oil or grease being introduced into tubing. Where contamination has occurred, material is no longer suitable for oxygen service.

Spacing of hangers: Current NFPA.

Rigidly support valves and other equipment to prevent strain on tube or joints.

While being brazed, joints shall be continuously purged with *oil* free nitrogen. The flow of purged gas shall be maintained until joint is cool to touch.

Do not bend tubing. Use fittings.

Support ceiling column assembly from heavy sub-mounting castings furnished with the unit as part of roughing-in. Anchor with 15 mm (1/2-inch) diameter bolts attached to angle iron frame supported from structural ceiling, unless otherwise indicated.

- J. Provide two 25 mm (1 inch) minimum conduits from ceiling column assembly to adjacent corridor, one for mass spectrometer tubing and wiring and one for monitor wiring, for connection to signal cabling network.
- K. Install pressure switches, transmitter and gauges to be easily accessed, and provide access panel where installed above plaster ceiling. Install pressure switch and sensors with orifice nipple between the pipe line and switches/sensors.
- L. Apply pipe labeling during installation process and not after installation is completed. Size of legend letters shall be in accordance with ANSI A13.1.
- M. Pipe compressor intake to a source of clean ambient air as indicated in current NFPA.
- N. After initial leakage testing is completed, allow piping to remain pressurized with testing gas until testing agency performs final tests.
- O. Penetrations:
 - Fire Stopping: Where pipes pass through fire partitions, fire walls, smoked partitions, or floors, install a fire stop that provides an effective barrier against the spread of fire, smoke and gases as specified in Section 07 84 00, FIRESTOPPING, with intumescent materials only. Completely fill and seal clearances between raceways and openings with the fire stopping material.
 - Waterproofing: At floor penetrations, completely seal clearances around the pipe and make watertight with sealant as specified in Section 07 92 00, JOINT SEALANTS.
- P. Provide 40mm (1 1/2 inch) diameter line pressure gage downstream of zone valve in cabinets.
- Q. Provide zone valves in cabinets where indicated and outside each Operating Room and a minimum one zone valve assembly for each 18 outlet set.

3.2 TESTS

Initial Tests: Blow down, and high and low pressure leakage tests as required by current NFPA with documentation.

Laboratory and healthcare testing agency shall perform the following: 1.

Perform and document all cross connection tests, labeling verification, supply system operation, and valve and alarm operation tests as required by, and in accordance with, current NFPA and the procedures set forth in pre-qualification documentation.

2. Verify that the systems, as installed, meet or exceed the requirements of current NFPA, this specification, and that the systems operate as required.
3. Piping purge test: For each positive pressure gas system, verify cleanliness of piping system. Filter a minimum of 35 cubic feet (1000 liters) of gas through a clean white 0.45 micron filter at a minimum velocity of 3.5 scfm (100 Lpm). Filter shall show no discoloration, and shall accrue no more than 0.1 mg of matter. Test each zone at the outlet most remote from the source. Perform test with the use of an inert gas as described in CGA P-9.
4. Piping purity test: For each positive pressure system, verify purity of piping system. Test each zone at the most remote outlet for dew point, carbon monoxide, total hydrocarbons (as methane), and halogenated hydrocarbons, and compare with source gas. The two tests must in no case exceed variation as specified in Paragraph, Maximum Allowable Variation. Perform test with the use of an inert gas as described in CGA P-9.
5. Outlet and inlet flow test:

Test all outlets for flow. Perform test with the use of an inert gas as described in CGA P-9.

Oxygen, nitrous oxide and air outlets must deliver 100 Lpm (3.5 scfm) with a pressure drop of no more than 35 kPa (5 psi), and static pressure of 350 kPa (50 psi).

Nitrogen outlets must deliver 565 Lpm (20 scfm) with a pressure drop of no more than 35 kPa (5 psi), and static pressure of 1445 kPa (210 psi).

Needle valve air outlets must deliver 1.5 scfm with a pressure drop of no more than five psi, and static pressure of 350 kPa (50 psi).
6. Source Contamination Test: Analyze each pressure gas source for concentration of contaminants, by volume. Take samples for air system test at the intake and at a point immediately downstream of the final filter outlet. The compared tests must in no case exceed variation as specified in Paragraph, Maximum Allowable Variation. Allowable concentrations are below the following:

Dew point, air	4 degrees C (39 degrees F) pressure dew point at 690 kPa (100 psi)
Carbon monoxide, air	10 mg/L (ppm)
Carbon dioxide, air	500 mg/L (ppm)

Gaseous hydrocarbons as methane, air	25 mg/L (ppm)
Halogenated hydrocarbons, air	2 mg/L (ppm)

7. Analysis Test:

Analyze each pressure gas source and outlet for concentration of gas, by volume.

Make analysis with instruments designed to measure the specific gas dispensed.

Allowable concentrations are within the following:

3.3 CONNECTION TO EXISTING LABORATORY GAS SYSTEM:

Contactors shall test the existing system for hydrocarbons, dew point, etc. If problems are present, the resident engineer (RE) would notify the facility of the results. The facility would then make the necessary repairs and/ or maintenance.

Install shut-off valve at the connection of new line to existing line. Coordinate time for shut-down of the existing laboratory and healthcare system with the VA medical center.

Shut off all oxygen zone valves and gas riser valves if the section to be connected to cannot be totally isolated from the remainder of the system.

Prior to any work being done, check the new pipeline for particulate or other forms of contamination.

Insure that the correct type of pipe tubing and fittings are being used. Make a spot check of the existing pipelines in the facility to determine the level of cleanness present.

Reduce the pressure to zero and make the tie-in as quickly as possible. A nitrogen purge is not required since this would require another opening in the pipe.

After the tie-in is made and allowed to cool, slowly bleed the source gas back into the pipeline. Test the work area for leaks with soapy water and repair any leaks.

After all leaks, if any, are repaired and the line is fully recharged, perform blow down and testing. Open the zone that is closest to the main to the system, access the closest outlet to the work, and blow the main through the outlet. After the outlet blows clear into a white cloth, make an additional check at a zone most distant from the work. Perform all required current NFPA tests after connection.

3.4 DEMONSTRATION AND TRAINING

Provide services of manufacturer's technical representative for four hours to instruct VA Personnel in operation and maintenance of units. Submit training plans and instructor qualifications in accordance with the requirements of Section 22 08 00, COMMISSIONING OF PLUMBING SYSTEMS.

- - - E N D - - -

SECTION 23 05 11
COMMON WORK RESULTS FOR HVAC

PART 1 - GENERAL

1.1 DESCRIPTION

The requirements of this Section apply to all sections of Division 23.

Definitions:

Exposed: Piping, ductwork, and equipment exposed to view in finished rooms.

Option or optional: Contractor's choice of an alternate material or method. 4. COTR: Contracting Officer's Technical Representative.

1.2 RELATED WORK

- A. Section 00 72 00, GENERAL CONDITIONS
- B. Section 01 00 00, GENERAL REQUIREMENTS
- C. Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, and SAMPLES
- D. Section 31 20 00, EARTH MOVING: Excavation and Backfill
- E. Section 03 30 00, CAST-IN-PLACE CONCRETE: Concrete and Grout
- F. Section 05 31 00, STEEL DECKING, and Section 05 36 00, COMPOSITE METAL DECKING: Building Components for Attachment of Hangers
- G. Section 05 50 00, METAL FABRICATIONS
- H. Section 07 84 00, FIRESTOPPING
- I. Section 07 60 00, FLASHING AND SHEET METAL: Flashing for Wall and Roof Penetrations
- J. Section 07 92 00, JOINT SEALANTS
- K. Section 09 51 00, ACOUSTICAL CEILINGS
- L. Section 09 91 00, PAINTING
- M. Section 13 05 41, SEISMIC RESTRAINT REQUIREMENTS FOR NON-STRUCTURAL COMPONENTS
- N. Section 23 05 12, GENERAL MOTOR REQUIREMENTS FOR HVAC and STEAM GENERATION
- O. Section 23 05 41, NOISE AND VIBRATION CONTROL FOR HVAC PIPING and EQUIPMENT
- P. Section 23 05 93, TESTING, ADJUSTING, and BALANCING FOR HVAC
- Q. Section 23 07 11, HVAC, PLUMBING, and Boiler Plant Insulation
- R. Section 23 09 23, DIRECT-DIGITAL CONTROL SYSTEM FOR HVAC
- S. Section 23 11 23, FACILITY NATURAL-GAS PIPING
- T. Section 23 21 13, HYDRONIC PIPING
- U. Section 23 21 23, HYDRONIC PUMPS
- V. Section 23 25 00, HVAC WATER TREATMENT
- W. Section 23 31 00, HVAC DUCTS and CASINGS

- W. Section 23 36 00, AIR TERMINAL UNITS
- X. Section 23 37 00, AIR OUTLETS and INLETS
- Y. Section 23 40 00, HVAC AIR CLEANING DEVICES
- Z. Section 23 64 00, PACKAGED WATER CHILLERS
- AA. Section 23 72 00, AIR-TO-AIR ENERGY RECOVERY EQUIPMENT
- BB. Section 23 82 00, CONVECTION HEATING and COOLING UNITS
- CC. Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS
- DD. Section 26 29 11, LOW-VOLTAGE MOTOR STARTERS

1.3 QUALITY ASSURANCE

- A. Mechanical, electrical and associated systems shall be safe, reliable, efficient, durable, easily and safely operable and maintainable, easily and safely accessible, and in compliance with applicable codes as specified. The systems shall be comprised of high quality institutional-class and industrial-class products of manufacturers that are experienced specialists in the required product lines. All construction firms and personnel shall be experienced and qualified specialists in industrial and institutional HVAC
- B. Flow Rate Tolerance for HVAC Equipment: Section 23 05 93, TESTING, ADJUSTING, AND BALANCING FOR HVAC.
- C. Equipment Vibration Tolerance:
 Refer to Section 23 05 41, NOISE AND VIBRATION CONTROL FOR HVAC PIPING and EQUIPMENT. Equipment shall be factory-balanced to this tolerance and re-balanced on site, as necessary.
 After HVAC air balance work is completed and permanent drive sheaves are in place, perform field mechanical balancing and adjustments required to meet the specified vibration tolerance.
- D. Products Criteria:
 Standard Products: Material and equipment shall be the standard products of a manufacturer regularly engaged in the manufacture of the products for at least 3 years (or longer as specified elsewhere). The design, model and size of each item shall have been in satisfactory and efficient operation on at least three installations for approximately three years. However, digital electronics devices, software and systems such as controls, instruments, computer work station, shall be the current generation of technology and basic design that has a proven satisfactory service record of at least three years. See other specification sections for any exceptions and/or additional requirements.
 All items furnished shall be free from defects that would adversely affect the performance, maintainability and appearance of individual components and overall assembly.

Conform to codes and standards as required by the specifications.

Conform to local codes, if required by local authorities such as the natural gas supplier, if the local codes are more stringent than those specified. Refer any conflicts to the COTR.

Multiple Units: When two or more units of materials or equipment of the same type or class are required, these units shall be products of one manufacturer.

Assembled Units: Manufacturers of equipment assemblies, which use components made by others, assume complete responsibility for the final assembled product.

Nameplates: Nameplate bearing manufacturer's name or identifiable trademark shall be securely affixed in a conspicuous place on equipment, or name or trademark cast integrally with equipment, stamped or otherwise permanently marked on each item of equipment.

Asbestos products or equipment or materials containing asbestos shall not be used.

E. Equipment Service Organizations:

1. HVAC: Products and systems shall be supported by service organizations that maintain a complete inventory of repair parts and are located within 50 miles to the site.

F. HVAC Mechanical Systems Welding: Before any welding is performed, contractor shall submit a certificate certifying that welders comply with the following requirements:

Qualify welding processes and operators for piping according to ASME "Boiler and Pressure Vessel Code", Section IX, "Welding and Brazing Qualifications".

Comply with provisions of ASME B31 series "Code for Pressure Piping". Certify that each welder has passed American Welding Society (AWS) qualification tests for the welding processes involved, and that certification is current.

G. Execution (Installation, Construction) Quality:

1. Apply and install all items in accordance with manufacturer's written instructions. Refer conflicts between the manufacturer's instructions and the contract drawings and specifications to the COTR for resolution. Provide written hard copies or computer files of manufacturer's installation instructions to the COTR at least two weeks prior to commencing installation of any item. Installation of the item will not be allowed to proceed until the recommendations are received. Failure to furnish these recommendations is a cause for rejection of the material.

2. Provide complete layout drawings required by Paragraph, SUBMITTALS.

Do not commence construction work on any system until the layout drawings have been approved.

H. Upon request by Government, provide lists of previous installations for selected items of equipment. Include contact persons who will serve as references, with telephone numbers and e-mail addresses.

1.4 SUBMITTALS

Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES, and with requirements in the individual specification sections.

Contractor shall make all necessary field measurements and investigations to assure that the equipment and assemblies will meet contract requirements.

If equipment is submitted which differs in arrangement from that shown, provide drawings that show the rearrangement of all associated systems. Approval will be given only if all features of the equipment and associated systems, including accessibility, are equivalent to that required by the contract.

Prior to submitting shop drawings for approval, contractor shall certify in writing that manufacturers of all major items of equipment have each reviewed drawings and specifications, and have jointly coordinated and properly integrated their equipment and controls to provide a complete and efficient installation.

Submittals and shop drawings for interdependent items, containing applicable descriptive information, shall be furnished together and complete in a group. Coordinate and properly integrate materials and equipment in each group to provide a completely compatible and efficient.

Layout Drawings:

Submit complete consolidated and coordinated layout drawings for all new systems, and for existing systems that are in the same areas. Refer to Section 00 72 00, GENERAL CONDITIONS, Article, SUBCONTRACTS AND WORK COORDINATION.

The drawings shall include plan views, elevations and sections of all systems and shall be on a scale of not less than 1:32 (3/8-inch equal to one foot). Clearly identify and dimension the proposed locations of the principal items of equipment. The drawings shall clearly show locations and adequate clearance for all equipment, piping, valves, control panels and other items. Show the access means for all items requiring access for operations and maintenance. Provide detailed layout drawings of all piping and duct systems.

Do not install equipment foundations, equipment or piping until layout drawings have been approved.

In addition, for HVAC systems, provide details of the following:

Mechanical equipment rooms.

Hangers, inserts, supports, and bracing.

Pipe sleeves.

Duct or equipment penetrations of floors, walls, ceilings, or roofs.

I. Manufacturer's Literature and Data: Submit under the pertinent section rather than under this section.

Submit belt drive with the driven equipment. Submit selection data for specific drives when requested by the COTR.

Submit electric motor data and variable speed drive data with the driven equipment.

Equipment and materials identification.

Fire-stopping materials.

Hangers, inserts, supports and bracing. Provide load calculations for variable spring and constant support hangers.

Wall, floor, and ceiling plates.

J. HVAC Maintenance Data and Operating Instructions:

Maintenance and operating manuals in accordance with Section 01 00 00, GENERAL REQUIREMENTS, Article, INSTRUCTIONS, for systems and equipment.

Provide a listing of recommended replacement parts for keeping in stock supply, including sources of supply, for equipment. Include in the listing belts for equipment: Belt manufacturer, model number, size and style, and distinguished whether of multiple belt sets.

K. Provide copies of approved HVAC equipment submittals to the Testing, Adjusting and Balancing Subcontractor.

1.5 APPLICABLE PUBLICATIONS

The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.

Air Conditioning, Heating and Refrigeration Institute (AHRI):

430-2009 Central Station Air-Handling Units

American National Standard Institute (ANSI):

B31.1-2007 Power Piping

Rubber Manufacturers Association (ANSI/RMA):

- IP-20-2007 Specifications for Drives Using Classical
V-Belts and Sheaves
- IP-21-2009 Specifications for Drives Using Double-V
(Hexagonal) Belts
- IP-22-2007 Specifications for Drives Using Narrow V-Belts
and Sheaves

Air Movement and Control Association (AMCA):

- 410-96 Recommended Safety Practices for Air Moving Devices

American Society of Mechanical Engineers (ASME):

Boiler and Pressure Vessel Code (BPVC):

- Section I-2007 Power Boilers
- Section IX-2007 Welding and Brazing Qualifications
- Code for Pressure Piping:

- B31.1-2007 Power Piping

American Society for Testing and Materials (ASTM):

- A36/A36M-08 Standard Specification for Carbon Structural
Steel
- A575-96(2007) Standard Specification for Steel Bars, Carbon,
Merchant Quality, M-Grades
- E84-10 Standard Test Method for Surface Burning
Characteristics of Building Materials
- E119-09c Standard Test Methods for Fire Tests of Building
Construction and Materials

Manufacturers Standardization Society (MSS) of the Valve and Fittings
Industry, Inc:

- SP-58-2009 Pipe Hangers and Supports-Materials, Design and
Manufacture, Selection, Application, and
Installation
- SP 69-2003 Pipe Hangers and Supports-Selection and
Application
- SP 127-2001 Bracing for Piping Systems, Seismic - Wind -
Dynamic, Design, Selection, Application

National Electrical Manufacturers Association (NEMA):

- MG-1-2009 Motors and Generators

National Fire Protection Association (NFPA):

- 31-06 Standard for Installation of Oil-Burning
Equipment
- 54-09 National Fuel Gas Code
- 70-08 National Electrical Code
- 85-07 Boiler and Combustion Systems Hazards Code

90A-09 Standard for the Installation of Air
 Conditioning and Ventilating Systems
 101-09 Life Safety Code

1.6 DELIVERY, STORAGE AND HANDLING

A. Protection of Equipment:

Equipment and material placed on the job site shall remain in the custody of the Contractor until phased acceptance, whether or not the Government has reimbursed the Contractor for the equipment and material. The Contractor is solely responsible for the protection of such equipment and material against any damage.

Place damaged equipment in first class, new operating condition; or, replace same as determined and directed by the COTR. Such repair or replacement shall be at no additional cost to the Government.

Protect interiors of new equipment and piping systems against entry of foreign matter. Clean both inside and outside before painting or placing equipment in operation.

Existing equipment and piping being worked on by the Contractor shall be under the custody and responsibility of the Contractor and shall be protected as required for new work.

B. Cleanliness of Piping and Equipment Systems:

Exercise care in storage and handling of equipment and piping material to be incorporated in the work. Remove debris arising from cutting, threading and welding of piping.

Piping systems shall be flushed, blown or pigged as necessary to deliver clean systems.

Clean interior of all tanks prior to delivery for beneficial use by the Government.

Contractor shall be fully responsible for all costs, damage, and delay arising from failure to provide clean systems.

PART 2 - PRODUCTS

2.1 FACTORY-ASSEMBLED PRODUCTS

Provide maximum standardization of components to reduce spare part requirements.

Manufacturers of equipment assemblies that include components made by others shall assume complete responsibility for final assembled unit. All components of an assembled unit need not be products of same manufacturer.

Constituent parts that are alike shall be products of a single manufacturer.

Components shall be compatible with each other and with the total assembly for intended service.

4. Contractor shall guarantee performance of assemblies of components, and shall repair or replace elements of the assemblies as required to deliver specified performance of the complete assembly.

Components of equipment shall bear manufacturer's name and trademark, model number, serial number and performance data on a name plate securely affixed in a conspicuous place, or cast integral with, stamped or otherwise permanently marked upon the components of the equipment. Major items of equipment, which serve the same function, must be the same make and model. Exceptions will be permitted if performance requirements cannot be met.

2.2 COMPATIBILITY OF RELATED EQUIPMENT

Equipment and materials installed shall be compatible in all respects with other items being furnished and with existing items so that the result will be a complete and fully operational plant that conforms to contract requirements.

2.3 BELT DRIVES

- A. Type: ANSI/RMA standard V-belts with proper motor pulley and driven sheave. Belts shall be constructed of reinforced cord and rubber.
- B. Dimensions, rating and selection standards: ANSI/RMA IP-20 and IP-21.
- C. Minimum Horsepower Rating: Motor horsepower plus recommended ANSI/RMA service factor (not less than 20 percent) in addition to the ANSI/RMA allowances for pitch diameter, center distance, and arc of contact.
- D. Maximum Speed: 25 m/s (5000 feet per minute).
- E. Adjustment Provisions: For alignment and ANSI/RMA standard allowances for installation and take-up.
- F. Drives may utilize a single V-Belt (any cross section) when it is the manufacturer's standard.
- G. Multiple Belts: Matched to ANSI/RMA specified limits by measurement on a belt measuring fixture. Seal matched sets together to prevent mixing or partial loss of sets. Replacement, when necessary, shall be an entire set of new matched belts.
- H. Sheaves and Pulleys:
 - Material: Pressed steel, or close grained cast iron.
 - Bore: Fixed or bushing type for securing to shaft with keys.
 - Balanced: Statically and dynamically.
 - Groove spacing for driving and driven pulleys shall be the same.
- I. Drive Types, Based on ARI 435:
 - 1. Provide adjustable-pitch or fixed-pitch drive as follows:
 - Fan speeds up to 1800 RPM: 7.5 kW (10 horsepower) and smaller.
 - Fan speeds over 1800 RPM: 2.2 kW (3 horsepower) and smaller.
 - 2. Provide fixed-pitch drives for drives larger than those listed above.

3. The final fan speeds required to just meet the system CFM and pressure requirements, without throttling, shall be determined by adjustment of a temporary adjustable-pitch motor sheave or by fan law calculation if a fixed-pitch drive is used initially.

2.4 DRIVE GUARDS

For machinery and equipment, provide guards as shown in AMCA 410 for belts, chains, couplings, pulleys, sheaves, shafts, gears and other moving parts regardless of height above the floor to prevent damage to equipment and injury to personnel. Drive guards may be excluded where motors and drives are inside factory fabricated air handling unit casings.

Pump shafts and couplings shall be fully guarded by a sheet steel guard, covering coupling and shaft but not bearings. Material shall be minimum 16-gage sheet steel; ends shall be braked and drilled and attached to pump base with minimum of four 6 mm (1/4-inch) bolts. Reinforce guard as necessary to prevent side play forcing guard onto couplings.

V-belt and sheave assemblies shall be totally enclosed, firmly mounted, non-resonant. Guard shall be an assembly of minimum 22-gage sheet steel and expanded or perforated metal to permit observation of belts. 25 mm (one-inch) diameter hole shall be provided at each shaft centerline to permit speed measurement.

Materials: Sheet steel, cast iron, expanded metal or wire mesh rigidly secured so as to be removable without disassembling pipe, duct, or electrical connections to equipment.

Access for Speed Measurement: 25 mm (One inch) diameter hole at each shaft center.

2.5 LIFTING ATTACHMENTS

Provide equipment with suitable lifting attachments to enable equipment to be lifted in its normal position. Lifting attachments shall withstand any handling conditions that might be encountered, without bending or distortion of shape, such as rapid lowering and braking of load.

2.6 ELECTRIC MOTORS

- A. All material and equipment furnished and installation methods shall conform to the requirements of Section 23 05 12, GENERAL MOTOR REQUIREMENTS FOR HVAC AND STEAM GENERATION EQUIPMENT; Section 26 29 11, LOW-VOLTAGE MOTOR STARTERS; and, Section 26 05 21, LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES (600 VOLTS AND BELOW). Provide all electrical wiring, conduit, and devices necessary for the proper connection, protection and operation of the systems. Provide special energy efficient premium efficiency type motors as scheduled.

2.7 VARIABLE SPEED MOTOR CONTROLLERS

Refer to Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS and Section 26 29 11, LOW-VOLTAGE MOTOR STARTERS for specifications.

The combination of controller and motor shall be provided by the manufacturer of the driven equipment, such as pumps and fans, and shall be rated for 100 percent output performance. Multiple units of the same class of equipment, i.e. air handlers, fans, pumps, shall be product of a single manufacturer.

Motors shall be premium efficiency type and be approved by the motor controller manufacturer. The controller-motor combination shall be guaranteed to provide full motor nameplate horsepower in variable frequency operation. Both driving and driven motor/fan sheaves shall be fixed pitch.

Controller shall not add any current or voltage transients to the input AC power distribution system, DDC controls, sensitive medical equipment, etc., nor shall be affected from other devices on the AC power system. Controller shall be provided with the following operating features and accessories:

Suitable for variable torque load.

Provide thermal magnetic circuit breaker or fused switch with external operator and incoming line fuses. Unit shall be rated for minimum 30,000 AIC. Provide AC input filters on incoming power line. The distance between the variable speed motor controller and motor shall not exceed 50 feet, and shall be in line of sight.

2.8 EQUIPMENT AND MATERIALS IDENTIFICATION

Use symbols, nomenclature and equipment numbers specified, shown on the drawings and shown in the maintenance manuals. Identification for piping is specified in Section 09 91 00, PAINTING.

Interior (Indoor) Equipment: Engraved nameplates, with letters not less than 48 mm (3/16-inch) high of brass with black-filled letters, or rigid black plastic with white letters specified in Section 09 91 00, PAINTING permanently fastened to the equipment. Identify unit components such as coils, filters, fans, etc.

Exterior (Outdoor) Equipment: Brass nameplates, with engraved black filled letters, not less than 48 mm (3/16-inch) high riveted or bolted to the equipment.

Control Items: Label all temperature and humidity sensors, controllers and control dampers. Identify and label each item as they appear on the control diagrams.

E. Valve Tags and Lists:

HVAC and Boiler Plant: Provide for all valves other than for equipment in Section 23 82 00, CONVECTION HEATING AND COOLING UNITS.

Valve tags: Engraved black filled numbers and letters not less than 13 mm (1/2-inch) high for number designation, and not less than 6.4 mm (1/4-inch) for service designation on 19 gage 38 mm (1-1/2 inches) round brass disc, attached with brass "S" hook or brass chain.

Valve lists: Typed or printed plastic coated card(s), sized 216 mm (8-1/2 inches) by 280 mm (11 inches) showing tag number, valve function and area of control, for each service or system. Punch sheets for a 3-ring notebook.

Provide detailed plan for each floor of the building indicating the location and valve number for each valve. Identify location of each valve with a color coded thumb tack in ceiling.

2.9 FIRESTOPPING

Section 07 84 00, FIRESTOPPING specifies an effective barrier against the spread of fire, smoke and gases where penetrations occur for piping and ductwork. Refer to Section 23 07 11, HVAC, PLUMBING, AND BOILER PLANT INSULATION, for firestop pipe and duct insulation.

2.10 GALVANIZED REPAIR COMPOUND

Mil. Spec. DOD-P-21035B, paint form.

2.11 HVAC PIPE AND EQUIPMENT SUPPORTS AND RESTRAINTS

A. Vibration Isolators: Refer to Section 23 05 41, NOISE AND VIBRATION CONTROL FOR HVAC PIPING AND EQUIPMENT.

B. Supports for Roof Mounted Items:

Equipment: Equipment rails shall be galvanized steel, minimum 1.3 mm (18 gauge), with integral baseplate, continuous welded corner seams, factory installed 50 mm by 100 mm (2 by 4) treated wood nailer, 1.3 mm (18 gauge) galvanized steel counter flashing cap with screws, built-in cant strip, (except for gypsum or tectum deck), minimum height 280 mm (11 inches). For surface insulated roof deck, provide raised cant strip to start at the upper surface of the insulation.

Pipe/duct pedestals: Provide a galvanized Unistrut channel welded to U-shaped mounting brackets which are secured to side of rail with galvanized lag bolts.

C. Pipe Supports: Comply with MSS SP-58. Type Numbers specified refer to this standard. For selection and application comply with MSS SP-69. Refer to Section 05 50 00, METAL FABRICATIONS, for miscellaneous metal support materials and prime coat painting requirements.

D. Attachment to Concrete Building Construction:

Concrete insert: MSS SP-58, Type 18.

Self-drilling expansion shields and machine bolt expansion anchors:

Permitted in concrete not less than 102 mm (four inches) thick when approved by the COTR for each job condition.

Power-driven fasteners: Permitted in existing concrete or masonry not less than 102 mm (four inches) thick when approved by the COTR for each job condition.

E. Attachment to Steel Building Construction:

Welded attachment: MSS SP-58, Type 22.

Beam clamps: MSS SP-58, Types 20, 21, 28 or 29. Type 23 C-clamp may be used for individual copper tubing up to 23mm (7/8-inch) outside diameter.

F. Attachment to Metal Pan or Deck: As required for materials specified in Section 05 31 00, STEEL DECKING.

G. Attachment to Wood Construction: Wood screws or lag bolts.

H. Hanger Rods: Hot-rolled steel, ASTM A36 or A575 for allowable load listed in MSS SP-58. For piping, provide adjustment means for controlling level or slope. Types 13 or 15 turn-buckles shall provide 38 mm (1-1/2 inches) minimum of adjustment and incorporate locknuts. All-thread rods are acceptable.

I. Hangers Supporting Multiple Pipes (Trapeze Hangers): Galvanized, cold formed, lipped steel channel horizontal member, not less than 41 mm by 41 mm (1-5/8 inches by 1-5/8 inches), 2.7 mm (No. 12 gage), designed to accept special spring held, hardened steel nuts. Not permitted for steam supply and condensate piping.

Allowable hanger load: Manufacturers rating less 91kg (200 pounds).

Guide individual pipes on the horizontal member of every other trapeze hanger with 6 mm (1/4-inch) U-bolt fabricated from steel rod.

Provide Type 40 insulation shield, secured by two 13mm (1/2-inch) galvanized steel bands, or preinsulated calcium silicate shield for insulated piping at each hanger.

J. Supports for Piping Systems:

1. Select hangers sized to encircle insulation on insulated piping.

Refer to Section 23 07 11, HVAC, PLUMBING, AND BOILER PLANT

INSULATION for insulation thickness. To protect insulation, provide Type 39 saddles for roller type supports or preinsulated calcium silicate shields. Provide Type 40 insulation shield or preinsulated calcium silicate shield at all other types of supports and hangers including those for preinsulated piping.

2. Piping Systems except High and Medium Pressure Steam (MSS SP-58):

- a. Standard clevis hanger: Type 1; provide locknut.
- b. Riser clamps: Type 8.
- c. Wall brackets: Types 31, 32 or 33.
- d. Roller supports: Type 41, 43, 44 and 46.
- e. Saddle support: Type 36, 37 or 38.
- f. Turnbuckle: Types 13 or 15. Preinsulate.
- g. U-bolt clamp: Type 24.
- h. Copper Tube:

Hangers, clamps and other support material in contact with tubing shall be painted with copper colored epoxy paint, plastic coated or taped with non adhesive isolation tape to prevent electrolysis.

For vertical runs use epoxy painted or plastic coated riser clamps.

For supporting tube to strut: Provide epoxy painted pipe straps for copper tube or plastic inserted vibration isolation clamps.

Insulated Lines: Provide pre-insulated calcium silicate shields sized for copper tube.

- i. Supports for plastic or glass piping: As recommended by the pipe manufacturer with black rubber tape extending one inch beyond steel support or clamp.

3. Convertor and Expansion Tank Hangers: May be Type 1 sized for the shell diameter. Insulation where required will cover the hangers. K. Pre-insulated Calcium Silicate Shields:

Provide 360 degree water resistant high density 965 kPa (140 psi) compressive strength calcium silicate shields encased in galvanized metal.

Pre-insulated calcium silicate shields to be installed at the point of support during erection.

Shield thickness shall match the pipe insulation.

The type of shield is selected by the temperature of the pipe, the load it must carry, and the type of support it will be used with.

- a. Shields for supporting chilled or cold water shall have insulation that extends a minimum of 1 inch past the sheet metal. Provide for an adequate vapor barrier in chilled lines.

- b. The pre-insulated calcium silicate shield shall support the maximum allowable water filled span as indicated in MSS-SP 69. To support the load, the shields may have one or more of the following features: structural inserts 4138 kPa (600 psi) compressive strength, an extra bottom metal shield, or formed structural steel (ASTM A36) wear plates welded to the bottom sheet metal jacket.
- 5. Shields may be used on steel clevis hanger type supports, roller supports or flat surfaces.
- L. Seismic Restraint of Piping and Ductwork: Refer to Section 13 05 41, SEISMIC RESTRAINT REQUIREMENTS FOR NON-STRUCTURAL COMPONENTS. Comply with MSS SP-127.

2.12 PIPE PENETRATIONS

- A. Install sleeves during construction for other than blocked out floor openings for risers in mechanical bays.
- B. To prevent accidental liquid spills from passing to a lower level, provide the following:
 - For sleeves: Extend sleeve 25 mm (one inch) above finished floor and provide sealant for watertight joint.
 - For blocked out floor openings: Provide 40 mm (1-1/2 inch) angle set in silicone adhesive around opening.
 - For drilled penetrations: Provide 40 mm (1-1/2 inch) angle ring or square set in silicone adhesive around penetration.
- C. Penetrations are not allowed through beams or ribs, but may be installed in concrete beam flanges. Any deviation from these requirements must receive prior approval of COTR.
- D. Sheet Metal, Plastic, or Moisture-resistant Fiber Sleeves: Provide for pipe passing through floors, interior walls, and partitions, unless brass or steel pipe sleeves are specifically called for below.
- E. Cast Iron or Zinc Coated Pipe Sleeves: Provide for pipe passing through exterior walls below grade. Make space between sleeve and pipe watertight with a modular or link rubber seal. Seal shall be applied at both ends of sleeve.
- F. Galvanized Steel or an alternate Black Iron Pipe with asphalt coating Sleeves: Provide for pipe passing through concrete beam flanges, except where brass pipe sleeves are called for. Provide sleeve for pipe passing through floor of mechanical rooms, laundry work rooms, and animal rooms above basement. Except in mechanical rooms, connect sleeve with floor plate.
- G. Brass Pipe Sleeves: Provide for pipe passing through quarry tile, terrazzo or ceramic tile floors. Connect sleeve with floor plate.

Sleeves are not required for wall hydrants for fire department connections or in drywall construction.

Sleeve Clearance: Sleeve through floors, walls, partitions, and beam flanges shall be one inch greater in diameter than external diameter of pipe. Sleeve for pipe with insulation shall be large enough to accommodate the insulation. Interior openings shall be caulked tight with fire stopping material and sealant to prevent the spread of fire, smoke, and gases.

Sealant and Adhesives: Shall be as specified in Section 07 92 00, JOINT SEALANTS.

2.13 DUCT PENETRATIONS

Provide curbs for roof mounted piping, ductwork and equipment. Curbs shall be 18 inches high with continuously welded seams, built-in cant strip, interior baffle with acoustic insulation, curb bottom, hinged curb adapter.

Provide firestopping for openings through fire and smoke barriers, maintaining minimum required rating of floor, ceiling or wall assembly. See section 07 84 00, FIRESTOPPING.

2.14 SPECIAL TOOLS AND LUBRICANTS

Furnish, and turn over to the COTR, tools not readily available commercially, that are required for disassembly or adjustment of equipment and machinery furnished.

Grease Guns with Attachments for Applicable Fittings: One for each type of grease required for each motor or other equipment.

Refrigerant Tools: Provide system charging/Evacuation equipment, gauges, fittings, and tools required for maintenance of furnished equipment.

Tool Containers: Hardwood or metal, permanently identified for in tended service and mounted, or located, where directed by the COTR.

Lubricants: A minimum of 0.95 L (one quart) of oil, and 0.45 kg (one pound) of grease, of equipment manufacturer's recommended grade and type, in unopened containers and properly identified as to use for each different application.

2.15 WALL, FLOOR AND CEILING PLATES

Material and Type: Chrome plated brass or chrome plated steel, one piece or split type with concealed hinge, with set screw for fastening to pipe, or sleeve. Use plates that fit tight around pipes, cover openings around pipes and cover the entire pipe sleeve projection.

Thickness: Not less than 2.4 mm (3/32-inch) for floor plates. For wall and ceiling plates, not less than 0.64 mm (0.025-inch) for up to 80 mm (3-inch pipe), 0.89 mm (0.035-inch) for larger pipe.

C. Locations: Use where pipe penetrates floors, walls and ceilings in exposed locations, in finished areas only. Provide a watertight joint in spaces where brass or steel pipe sleeves are specified.

2.16 ASBESTOS

Materials containing asbestos are not permitted.

PART 3 - EXECUTION

3.1 ARRANGEMENT AND INSTALLATION OF EQUIPMENT AND PIPING

Coordinate location of piping, sleeves, inserts, hangers, ductwork and equipment. Locate piping, sleeves, inserts, hangers, ductwork and equipment clear of windows, doors, openings, light outlets, and other services and utilities. Prepare equipment layout drawings to coordinate proper location and personnel access of all facilities. Submit the drawings for review as required by Part 1. Follow manufacturer's published recommendations for installation methods not otherwise specified.

Operating Personnel Access and Observation Provisions: Select and arrange all equipment and systems to provide clear view and easy access, without use of portable ladders, for maintenance and operation of all devices including, but not limited to: all equipment items, valves, filters, strainers, transmitters, sensors, control devices. All gages and indicators shall be clearly visible by personnel standing on the floor or on permanent platforms. Do not reduce or change maintenance and operating space and access provisions that are shown on the drawings.

Equipment and Piping Support: Coordinate structural systems necessary for pipe and equipment support with pipe and equipment locations to permit proper installation.

Location of pipe sleeves, trenches and chases shall be accurately coordinated with equipment and piping locations.

Cutting Holes:

Cut holes through concrete and masonry by rotary core drill. Pneumatic hammer, impact electric, and hand or manual hammer type drill will not be allowed, except as permitted by COTR where working area space is limited.

Locate holes to avoid interference with structural members such as beams or grade beams. Holes shall be laid out in advance and drilling done only after approval by COTR. If the Contractor considers it necessary to drill through structural members, this matter shall be referred to COTR for approval.

Do not penetrate membrane waterproofing.

- F. Interconnection of Instrumentation or Control Devices: Generally, electrical and pneumatic interconnections are not shown but must be provided.
- G. Minor Piping: Generally, small diameter pipe runs from drips and drains, water cooling, and other service are not shown but must be provided.
- H. Protection and Cleaning:
Equipment and materials shall be carefully handled, properly stored, and adequately protected to prevent damage before and during installation, in accordance with the manufacturer's recommendations and as approved by the COTR. Damaged or defective items in the opinion of the COTR, shall be replaced.
Protect all finished parts of equipment, such as shafts and bearings where accessible, from rust prior to operation by means of protective grease coating and wrapping. Close pipe openings with caps or plugs during installation. Tightly cover and protect fixtures and equipment against dirt, water chemical, or mechanical injury. At completion of all work thoroughly clean fixtures, exposed materials and equipment.
- I. Concrete and Grout: Use concrete and shrink compensating grout 25 MPa (3000 psi) minimum, specified in Section 03 30 00, CAST-IN-PLACE CONCRETE.
- J. Install gages, thermometers, valves and other devices with due regard for ease in reading or operating and maintaining said devices. Locate and position thermometers and gages to be easily read by operator or staff standing on floor or walkway provided. Servicing shall not require dismantling adjacent equipment or pipe work.
- K. Switchgear/Electrical Equipment Drip Protection: Every effort shall be made to eliminate the installation of pipe above electrical and telephone switchgear. If this is not possible, encase pipe in a second pipe with a minimum of joints. Installation of piping, ductwork, leak protection apparatus or other installations foreign to the electrical installation shall be located in the space equal to the width and depth of the equipment and extending from to a height of 1.8 m (6 ft.) above the equipment of to ceiling structure, whichever is lower (NFPA 70).
- L. Inaccessible Equipment:
1. Where the Government determines that the Contractor has installed equipment not conveniently accessible for operation and maintenance, equipment shall be removed and reinstalled or remedial action performed as directed at no additional cost to the Government.

2. The term "conveniently accessible" is defined as capable of being reached without the use of ladders, or without climbing or crawling under or over obstacles such as motors, fans, pumps, belt guards, transformers, high voltage lines, piping, and ductwork.

3.2 RIGGING

Design is based on application of available equipment. Openings in building structures are planned to accommodate design scheme. Alternative methods of equipment delivery may be offered by Contractor and will be considered by Government under specified restrictions of phasing and maintenance of service as well as structural integrity of the building.

Close all openings in the building when not required for rigging operations to maintain proper environment in the facility for Government operation and maintenance of service.

Contractor shall provide all facilities required to deliver specified equipment and place on foundations. Attachments to structures for rigging purposes and support of equipment on structures shall be Contractor's full responsibility. Upon request, the Government will check structure adequacy and advise Contractor of recommended restrictions.

Contractor shall check all clearances, weight limitations and shall offer a rigging plan designed by a Registered Professional Engineer. All modifications to structures, including reinforcement thereof, shall be at Contractor's cost, time and responsibility.

Rigging plan and methods shall be referred to COTR for evaluation prior to actual work.

Restore building to original condition upon completion of rigging work.

3.3 PIPE AND EQUIPMENT SUPPORTS

Where hanger spacing does not correspond with joist or rib spacing, use structural steel channels secured directly to joist and rib structure that will correspond to the required hanger spacing, and then suspend the equipment and piping from the channels. Drill or burn holes in structural steel only with the prior approval of the COTR.

Use of chain, wire or strap hangers; wood for blocking, stays and bracing; or, hangers suspended from piping above will not be permitted. Replace or thoroughly clean rusty products and paint with zinc primer.

Use hanger rods that are straight and vertical. Turnbuckles for vertical adjustments may be omitted where limited space prevents use. Provide a minimum of 15 mm (1/2-inch) clearance between pipe or piping covering and adjacent work.

- D. HVAC Horizontal Pipe Support Spacing: Refer to MSS SP-69. Provide additional supports at valves, strainers, in-line pumps and other heavy components. Provide a support within one foot of each elbow.
- E. HVAC Vertical Pipe Supports:
Up to 150 mm (6-inch pipe), 9 m (30 feet) long, bolt riser clamps to the pipe below couplings, or welded to the pipe and rests supports securely on the building structure.
Vertical pipe larger than the foregoing, support on base elbows or tees, or substantial pipe legs extending to the building structure.
- F. Overhead Supports:
The basic structural system of the building is designed to sustain the loads imposed by equipment and piping to be supported overhead. Provide steel structural members, in addition to those shown, of adequate capability to support the imposed loads, located in accordance with the final approved layout of equipment and piping. Tubing and capillary systems shall be supported in channel troughs.
- G. Floor Supports:
Provide concrete bases, concrete anchor blocks and pedestals, and structural steel systems for support of equipment and piping. Anchor and dowel concrete bases and structural systems to resist forces under operating and seismic conditions (if applicable) without excessive displacement or structural failure.
Do not locate or install bases and supports until equipment mounted thereon has been approved. Size bases to match equipment mounted thereon plus 50 mm (2 inch) excess on all edges. Boiler foundations shall have horizontal dimensions that exceed boiler base frame dimensions by at least 150 mm (6 inches) on all sides. Refer to structural drawings. Bases shall be neatly finished and smoothed, shall have chamfered edges at the top, and shall be suitable for painting.
All equipment shall be shimmed, leveled, firmly anchored, and grouted with epoxy grout. Anchor bolts shall be placed in sleeves, anchored to the bases. Fill the annular space between sleeves and bolts with a granular material to permit alignment and realignment.
For seismic anchoring, refer to Section 13 05 41, SEISMIC RESTRAINT REQUIREMENTS FOR NON-STRUCTURAL COMPONENTS.

3.4 CLEANING AND PAINTING

- A. Prior to final inspection and acceptance of the plant and facilities for beneficial use by the Government, the plant facilities, equipment and systems shall be thoroughly cleaned and painted. Refer to Section 09 91 00, PAINTING.

- B. In addition, the following special conditions apply:
1. Cleaning shall be thorough. Use solvents, cleaning materials and methods recommended by the manufacturers for the specific tasks. Remove all rust prior to painting and from surfaces to remain unpainted. Repair scratches, scuffs, and abrasions prior to applying prime and finish coats.
 2. Material And Equipment Not To Be Painted Includes:
 - Motors, controllers, control switches, and safety switches.
 - Control and interlock devices.
 - Regulators.
 - Pressure reducing valves.
 - Control valves and thermostatic elements.
 - Lubrication devices and grease fittings.
 - Copper, brass, aluminum, stainless steel and bronze surfaces.
 - Valve stems and rotating shafts.
 - Pressure gauges and thermometers.
 - Glass.
 - Name plates.
 3. Control and instrument panels shall be cleaned, damaged surfaces repaired, and shall be touched-up with matching paint obtained from panel manufacturer.
 4. Pumps, motors, steel and cast iron bases, and coupling guards shall be cleaned, and shall be touched-up with the same color as utilized by the pump manufacturer
 5. Temporary Facilities: Apply paint to surfaces that do not have existing finish coats.
 6. Paint shall withstand the following temperatures without peeling or discoloration:
 - Condensate and feedwater -- 38 degrees C (100 degrees F) on insulation jacket surface and 120 degrees C (250 degrees F) on metal pipe surface.
 - Steam -- 52 degrees C (125 degrees F) on insulation jacket surface and 190 degrees C (375 degrees F) on metal pipe surface.
 7. Final result shall be smooth, even-colored, even-textured factory finish on all items. Completely repaint the entire piece of equipment if necessary to achieve this.

3.5 IDENTIFICATION SIGNS

Provide laminated plastic signs, with engraved lettering not less than 5 mm (3/16-inch) high, designating functions, for all equipment, switches, motor controllers, relays, meters, control devices, including automatic control valves. Nomenclature and identification symbols shall correspond to that used in maintenance manual, and in diagrams specified elsewhere. Attach by chain, adhesive, or screws.

Factory Built Equipment: Metal plate, securely attached, with name and address of manufacturer, serial number, model number, size, performance.

Pipe Identification: Refer to Section 09 91 00, PAINTING.

3.6 MOTOR AND DRIVE ALIGNMENT

Belt Drive: Set driving and driven shafts parallel and align so that the corresponding grooves are in the same plane.

Direct-connect Drive: Securely mount motor in accurate alignment so that shafts are free from both angular and parallel misalignment when both motor and driven machine are operating at normal temperatures.

3.7 LUBRICATION

Lubricate all devices requiring lubrication prior to initial operation.

Field-check all devices for proper lubrication.

Equip all devices with required lubrication fittings or devices. Provide a minimum of one liter (one quart) of oil and 0.5 kg (one pound) of grease of manufacturer's recommended grade and type for each different application; also provide 12 grease sticks for lubricated plug valves. Deliver all materials to COTR in unopened containers that are properly identified as to application.

Provide a separate grease gun with attachments for applicable fittings for each type of grease applied.

All lubrication points shall be accessible without disassembling equipment, except to remove access plates.

3.8 HVAC SYSTEMS COMMISSIONING

A. Commissioning will be accomplished by a third party contracted by the A/E firm. Allow access to HVAC documents, data and facility during this commissioning. Contractor to work closely with COTR, Commissioning Firm, and Subcontractors to assist with scheduling and commissioning.

3.9 STARTUP AND TEMPORARY OPERATION

Start up equipment as described in equipment specifications. Verify that vibration is within specified tolerance prior to extended operation. Temporary use of equipment is specified in Section 01 00 00, GENERAL REQUIREMENTS, Article, TEMPORARY USE OF MECHANICAL AND ELECTRICAL EQUIPMENT.

3.10 OPERATING AND PERFORMANCE TESTS

Prior to the final inspection, perform required tests as specified in Section 01 00 00, GENERAL REQUIREMENTS and submit the test reports and records to the COTR.

Should evidence of malfunction in any tested system, or piece of equipment or component part thereof, occur during or as a result of tests, make proper corrections, repairs or replacements, and repeat tests at no additional cost to the Government.

When completion of certain work or system occurs at a time when final control settings and adjustments cannot be properly made to make performance tests, then make performance tests for heating systems and for cooling systems respectively during first actual seasonal use of respective systems following completion of work.

3.11 INSTRUCTIONS TO VA PERSONNEL

Provide in accordance with Article, INSTRUCTIONS, of Section 01 00 00, GENERAL REQUIREMENTS, and Section 23 08 11, DEMONSTRATIONS AND TESTS FOR BOILER PLANT.

- - - E N D - - -

SECTION 23 05 12
GENERAL MOTOR REQUIREMENTS FOR HVAC AND STEAM GENERATION EQUIPMENT

PART 1 - GENERAL

1.1 DESCRIPTION:

This section specifies the furnishing, installation and connection of motors for HVAC and steam generation equipment.

1.2 RELATED WORK:

Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS: General electrical requirements common to more than one Section of Division 26.

Section 26 29 11, LOW-VOLTAGE MOTOR STARTERS: Starters, control and protection for motors.

Section 26 24 19, MOTOR-CONTROL CENTERS: Multiple motor control assemblies, which include motor starters.

Section 23 05 11, COMMON WORK RESULTS FOR HVAC.

Section 23 21 23, HYDRONIC PUMPS.

Section 23 36 00, AIR TERMINAL UNITS.

Section 23 64 00, PACKAGED WATER CHILLERS.

Section 23 72 00, AIR-TO-AIR ENERGY RECOVERY EQUIPMENT.

Section 23 82 00, CONVECTION HEATING and COOLING UNITS.

1.3 SUBMITTALS:

A. In accordance with Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS, submit the following:

B. Shop Drawings:

Provide documentation to demonstrate compliance with drawings and specifications.

Include electrical ratings, efficiency, bearing data, power factor, frame size, dimensions, mounting details, materials, horsepower, voltage, phase, speed (RPM), enclosure, starting characteristics, torque characteristics, code letter, full load and locked rotor current, service factor, and lubrication method.

C. Manuals:

1. Submit simultaneously with the shop drawings, companion copies of complete installation, maintenance and operating manuals, including technical data sheets and application data.

D. Certification: Two weeks prior to final inspection, unless otherwise noted, submit four copies of the following certification to the COTR:

1. Certification that the motors have been applied, installed, adjusted, lubricated, and tested according to manufacturer published recommendations.

E. Completed System Readiness Checklists provided by the Commissioning Agent and completed by the contractor, signed by a qualified technician and dated on the date of completion, in accordance with the requirements of Section 23 08 00 COMMISSIONING OF HVAC SYSTEMS.

1.4 APPLICABLE PUBLICATIONS:

The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.

National Electrical Manufacturers Association (NEMA):

MG 1-2006 Rev. 1 2009 .Motors and Generators

MG 2-2001 Rev. 1 2007 . Safety Standard for Construction and Guide for Selection, Installation and Use of Electric Motors and Generators

National Fire Protection Association (NFPA):

70-2008 National Electrical Code (NEC)

Institute of Electrical and Electronics Engineers (IEEE):

112-04 Standard Test Procedure for Polyphase Induction Motors and Generators

American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE):

90.1-2007 Energy Standard for Buildings Except Low-Rise Residential Buildings

PART 2 - PRODUCTS

2.1 MOTORS:

For alternating current, fractional and integral horsepower motors, NEMA Publications MG 1 and MG 2 shall apply.

All material and equipment furnished and installation methods shall conform to the requirements of Section 26 29 11, LOW-VOLTAGE MOTOR STARTERS; and Section 26 05 21, LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES (600 VOLTS AND BELOW). Provide all electrical wiring, conduit, and devices necessary for the proper connection, protection and operation of the systems. Provide premium efficiency type motors as scheduled. Unless otherwise specified for a particular application, use electric motors with the following requirements.

Single-phase Motors: Motors for centrifugal fans and pumps may be split phase or permanent split capacitor (PSC) type. Provide capacitor-start type for hard starting applications.

1. Contractor's Option - Electrically Commutated motor (EC Type): Motor shall be brushless DC type specifically designed for applications

with heavy duty ball bearings and electronic commutation. The motor shall be speed controllable down to 20% of full speed and 85% efficient at all speeds.

D. Poly-phase Motors: NEMA Design B, Squirrel cage, induction type.

1. Two Speed Motors: Each two-speed motor shall have two separate windings. Provide a time- delay (20 seconds minimum) relay for switching from high to low speed.

E. Voltage ratings shall be as follows:

1. Single phase:

Motors connected to 120-volt systems: 115 volts.

Motors connected to 208-volt systems: 200 volts.

Motors connected to 240 volt or 480 volt systems: 230/460 volts, dual connection.

2. Three phase:

Motors connected to 208-volt systems: 200 volts.

Motors, less than 74.6 kW (100 HP), connected to 240 volt or 480 volt systems: 208-230/460 volts, dual connection.

Motors, 74.6 kW (100 HP) or larger, connected to 240-volt systems: 230 volts.

Motors, 74.6 kW (100 HP) or larger, connected to 480-volt systems: 460 volts.

F. Number of phases shall be as follows:

Motors, less than 373 W (1/2 HP): Single phase.

Motors, 373 W (1/2 HP) and larger: 3 phase.

Exceptions:

Hermetically sealed motors.

Motors for equipment assemblies, less than 746 W (one HP), may be single phase provided the manufacturer of the proposed assemblies cannot supply the assemblies with three phase motors.

G. Motors shall be designed for operating the connected loads continuously in a 40°C (104°F) environment, where the motors are installed, without exceeding the NEMA standard temperature rises for the motor insulation. If the motors exceed 40°C (104°F), the motors shall be rated for the actual ambient temperatures.

H. Motor designs, as indicated by the NEMA code letters, shall be coordinated with the connected loads to assure adequate starting and running torque.

I. Motor Enclosures:

1. Shall be the NEMA types as specified and/or shown on the drawings.
2. Where the types of motor enclosures are not shown on the drawings, they shall be the NEMA types, which are most suitable for the environmental conditions where the motors are being installed.

Enclosure requirements for certain conditions are as follows:

Motors located outdoors, indoors in wet or high humidity locations, or in unfiltered airstreams shall be totally enclosed type.

Where motors are located in an NEC 511 classified area, provide TEFC explosion proof motor enclosures.

Where motors are located in a corrosive environment, provide TEFC enclosures with corrosion resistant finish.

3. Enclosures shall be primed and finish coated at the factory with manufacturer's prime coat and standard finish.

J. Special Requirements:

1. Where motor power requirements of equipment furnished deviate from power shown on plans, provide electrical service designed under the requirements of NFPA 70 without additional time or cost to the Government.
2. Assemblies of motors, starters, controls and interlocks on factory assembled and wired devices shall be in accordance with the requirements of this specification.
3. Wire and cable materials specified in the electrical division of the specifications shall be modified as follows:
Wiring material located where temperatures can exceed 71 degrees C (160 degrees F) shall be stranded copper with Teflon FEP insulation with jacket. This includes wiring on the boilers.
Other wiring at boilers and to control panels shall be NFPA 70 designation THWN.
Provide shielded conductors or wiring in separate conduits for all instrumentation and control systems where recommended by manufacturer of equipment.
4. Select motor sizes so that the motors do not operate into the service factor at maximum required loads on the driven equipment. Motors on pumps shall be sized for non-overloading at all points on the pump performance curves.
5. Motors utilized with variable frequency drives shall be rated "inverter-duty" per NEMA Standard, MG1, Part 31.4.4.2. Provide motor

shaft grounding apparatus that will protect bearings from damage from stray currents.

Additional requirements for specific motors, as indicated in the other sections listed in Article 1.2, shall also apply.

Energy-Efficient Motors (Motor Efficiencies): All permanently wired polyphase motors of 746 Watts (1 HP) or more shall meet the minimum full-load efficiencies as indicated in the following table. Motors of 746 Watts or more with open, drip-proof or totally enclosed fan-cooled enclosures shall be NEMA premium efficiency type, unless otherwise indicated. Motors provided as an integral part of motor driven equipment are excluded from this requirement if a minimum seasonal or overall efficiency requirement is indicated for that equipment by the provisions of another section. Motors not specified as "premium efficiency" shall comply with the Energy Policy Act of 2005 (EPACT).

Minimum Premium Efficiencies Open Drip-Proof				Minimum Premium Efficiencies Totally Enclosed Fan-Cooled			
Rating kw (HP)	1200 RPM	1800 RPM	3600 RPM	Rating kw (HP)	1200 RPM	1800 RPM	3600 RPM
0.746 (1)	82.5%	85.5%	77.0%	0.746 (1)	82.5%	85.5%	77.0%
1.12 (1.5)	86.5%	86.5%	84.0%	1.12 (1.5)	87.5%	86.5%	84.0%
1.49 (2)	87.5%	86.5%	85.5%	1.49 (2)	88.5%	86.5%	85.5%
2.24 (3)	88.5%	89.5%	85.5%	2.24 (3)	89.5%	89.5%	86.5%
3.73 (5)	89.5%	89.5%	86.5%	3.73 (5)	89.5%	89.5%	88.5%
5.60 (7.5)	90.2%	91.0%	88.5%	5.60 (7.5)	91.0%	91.7%	89.5%
7.46 (10)	91.7%	91.7%	89.5%	7.46 (10)	91.0%	91.7%	90.2%
11.2 (15)	91.7%	93.0%	90.2%	11.2 (15)	91.7%	92.4%	91.0%
14.9 (20)	92.4%	93.0%	91.0%	14.9 (20)	91.7%	93.0%	91.0%
18.7 (25)	93.0%	93.6%	91.7%	18.7 (25)	93.0%	93.6%	91.7%
22.4 (30)	93.6%	94.1%	91.7%	22.4 (30)	93.0%	93.6%	91.7%
29.8 (40)	94.1%	94.1%	92.4%	29.8 (40)	94.1%	94.1%	92.4%
37.3 (50)	94.1%	94.5%	93.0%	37.3 (50)	94.1%	94.5%	93.0%
44.8 (60)	94.5%	95.0%	93.6%	44.8 (60)	94.5%	95.0%	93.6%
56.9 (75)	94.5%	95.0%	93.6%	56.9 (75)	94.5%	95.4%	93.6%
74.6 (100)	95.0%	95.4%	93.6%	74.6 (100)	95.0%	95.4%	94.1%
93.3 (125)	95.0%	95.4%	94.1%	93.3 (125)	95.0%	95.4%	95.0%
112 (150)	95.4%	95.8%	94.1%	112 (150)	95.8%	95.8%	95.0%
149.2 (200)	95.4%	95.8%	95.0%	149.2 (200)	95.8%	96.2%	95.4%

M. Minimum Power Factor at Full Load and Rated Voltage: 90 percent at 1200 RPM, 1800 RPM and 3600 RPM.

PART 3 - EXECUTION

3.1 INSTALLATION:

Install motors in accordance with manufacturer's recommendations, the NEC, NEMA, as shown on the drawings and/or as required by other sections of these specifications.

3.2 FIELD TESTS

Perform an electric insulation resistance Test using a megohmmeter on all motors after installation, before start-up. All shall test free from grounds.

Perform Load test in accordance with ANSI/IEEE 112, Test Method B, to determine freedom from electrical or mechanical defects and compliance with performance data.

Insulation Resistance: Not less than one-half meg-ohm between stator conductors and frame, to be determined at the time of final inspection.

3.3 STARTUP AND TESTING

A. The Commissioning Agent will observe startup and contractor testing of selected equipment. Coordinate the startup and contractor testing schedules with COTR and Commissioning Agent. Provide a minimum of 7 days prior notice.

3.4 DEMONSTRATION AND TRAINING

Provide services of manufacturer's technical representative for four hours to instruct VA personnel in operation and maintenance of units. Submit training plans and instructor qualifications in accordance with the requirements of Section 23 08 00 - COMMISSIONING OF HVAC SYSTEMS. - - - E N D - - -

SECTION 23 05 41
NOISE AND VIBRATION CONTROL FOR HVAC PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 DESCRIPTION

Noise criteria, seismic restraints for equipment, vibration tolerance and vibration isolation for HVAC and plumbing work.

1.2 RELATED WORK

Section 03 30 00, CAST-IN-PLACE CONCRETE: Requirements for concrete inertia bases.

Section 13 05 41, SEISMIC RESTRAINT REQUIREMENTS FOR NON-STRUCTURAL COMPONENTS: Seismic requirements for non-structural equipment

Section 23 05 11, COMMON WORK RESULTS FOR HVAC and STEAM GENERATION:

General mechanical requirements and items, which are common to more than one section of Division 23.

Section 23 31 00, HVAC DUCTS and CASINGS: requirements for flexible duct connectors, sound attenuators and sound absorbing duct lining.

SECTION 23 05 93, TESTING, ADJUSTING, and BALANCING FOR HVAC: requirements for sound and vibration tests.

SECTION 23 37 00, AIR OUTLETS and INLETS: noise requirements for G-grilles.

SECTION 23 21 23, HYDRONIC PUMPS: vibration isolation requirements for pumps.

SECTION 23 34 00, HVAC FANS: sound and vibration isolation requirements for fans.

SECTION 26 32 13, ENGINEER GENERATORS: requirements for sound and vibration isolation.

1.3 QUALITY ASSURANCE

Refer to article, QUALITY ASSURANCE in specification Section 23 05 11, COMMON WORK RESULTS FOR HVAC.

Noise Criteria:

- Noise levels in all 8 octave bands due to equipment and duct systems shall not exceed following NC levels:

TYPE OF ROOM	NC LEVEL
Bathrooms and Toilet Rooms	40
Corridors(Public)	40
Dining Rooms, Food Services/ Serving	40
Gymnasiums	50

Kitchens	50
Laundries	50
Offices, Small Private	35
Therapeutic Pools	45

For equipment which has no sound power ratings scheduled on the plans, the contractor shall select equipment such that the foregoing noise criteria, local ordinance noise levels, and OSHA requirements are not exceeded. Selection procedure shall be in accordance with ASHRAE Fundamentals Handbook, Chapter 7, Sound and Vibration.

An allowance, not to exceed 5db, may be added to the measured value to compensate for the variation of the room attenuating effect between room test condition prior to occupancy and design condition after occupancy which may include the addition of sound absorbing material, such as, furniture. This allowance may not be taken after occupancy. The room attenuating effect is defined as the difference between sound power level emitted to room and sound pressure level in room.

In absence of specified measurement requirements, measure equipment noise levels three feet from equipment and at an elevation of maximum noise generation.

C. Seismic Restraint Requirements:

1. Equipment:

All mechanical equipment not supported with isolators external to the unit shall be securely anchored to the structure. Such mechanical equipment shall be properly supported to resist a horizontal force of 20 percent of the weight of the equipment furnished.

All mechanical equipment mounted on vibration isolators shall be provided with seismic restraints capable of resisting a horizontal force of 50 percent of the weight of the equipment furnished.

2. Piping: Refer to specification Section 23 05 11, COMMON WORK RESULTS FOR HVAC.

3. Ductwork: Refer to specification Section 23 31 00, HVAC DUCTS AND CASINGS.

Allowable Vibration Tolerances for Rotating, Non-reciprocating Equipment:

Not to exceed a self-excited vibration maximum velocity of 5 mm per second (0.20 inch per second) RMS, filter in, when measured with a vibration meter on bearing caps of machine in vertical, horizontal and axial directions or measured at equipment mounting feet if bearings are concealed. Measurements for internally isolated fans and motors may be made at the mounting feet.

1.4 SUBMITTALS

- A. Submit in accordance with specification Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, and SAMPLES.
- B. Manufacturer's Literature and Data:
 - 1. Vibration isolators:
 - Floor mountings
 - Hangers
 - Snubbers
 - Thrust restraints
 - 2. Bases.
 - 3. Seismic restraint provisions and bolting.
 - 4. Acoustical enclosures.
- C. Isolator manufacturer shall furnish with submittal load calculations for selection of isolators, including supplemental bases, based on lowest operating speed of equipment supported.
- D. Seismic Requirements: Submittals are required for all equipment anchors, supports and seismic restraints. Submittals shall include weights, dimensions, standard connections, and manufacturer's certification that all specified equipment will withstand seismic Lateral Force requirements as shown on drawings.

1.5 APPLICABLE PUBLICATIONS

The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.

American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc. (ASHRAE):

2009 Fundamentals Handbook, Chapter 7, Sound and Vibration

American Society for Testing and Materials (ASTM):

A123/A123M-09 Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products

A307-07b Standard Specification for Carbon Steel Bolts
and Studs, 60,000 PSI Tensile Strength

D2240-05(2010) Standard Test Method for Rubber Property -
Durometer Hardness

Manufacturers Standardization (MSS):

SP-58-2009 Pipe Hangers and Supports-Materials, Design and
Manufacture

Occupational Safety and Health Administration (OSHA):

29 CFR 1910.95 Occupational Noise Exposure

American Society of Civil Engineers (ASCE):

ASCE 7-10 Minimum Design Loads for Buildings and Other
Structures.

American National Standards Institute / Sheet Metal and Air

Conditioning Contractor's National Association (ANSI/SMACNA):

001-2008 Seismic Restraint Manual: Guidelines for
Mechanical Systems, 3rd Edition.

International Code Council (ICC):

2009 IBC International Building Code.

Department of Veterans Affairs (VA):

H-18-8 2010 Seismic Design Requirements.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS

Type of isolator, base, and minimum static deflection shall be as
required for each specific equipment application as recommended by
isolator or equipment manufacturer but subject to minimum
requirements indicated herein and in the schedule on the drawings.

Elastometric Isolators shall comply with ASTM D2240 and be oil resistant
neoprene with a maximum stiffness of 60 durometer and have a
straight-line deflection curve.

Exposure to weather: Isolator housings to be either hot dipped galvanized
or powder coated to ASTM B117 salt spray testing standards. Springs to
be powder coated or electro galvanized. All hardware to be electro
galvanized. In addition provide limit stops to resist wind velocity.
Velocity pressure established by wind shall be calculated in
accordance with section 1609 of the International Building Code. A
minimum wind velocity of 75 mph shall be employed.

Uniform Loading: Select and locate isolators to produce uniform loading and
deflection even when equipment weight is not evenly distributed.

E. Color code isolators by type and size for easy identification of capacity.

2.2 SEISMIC RESTRAINT REQUIREMENTS FOR EQUIPMENTS

Bolt pad mounted equipment, without vibration isolators, to the floor or other support using ASTM A307 standard bolting material.

Floor mounted equipment, with vibration Isolators: Type SS. Where Type N isolators are used provide channel frame base horizontal restraints bolted to the floor, or other support, on all sides of the equipment. Size and material required for the base shall be as recommended by the isolator manufacturer.

On all sides of suspended equipment, provide bracing for rigid supports and provide restraints for resiliently supported equipment.

2.3 VIBRATION ISOLATORS

A. Floor Mountings:

Double Deflection Neoprene (Type N): Shall include neoprene covered steel support plated (top and bottom), friction pads, and necessary bolt holes.

Spring Isolators (Type S): Shall be free-standing, laterally stable and include acoustical friction pads and leveling bolts. Isolators shall have a minimum ratio of spring diameter-to-operating spring height of 1.0 and an additional travel to solid equal to 50 percent of rated deflection.

Captive Spring Mount for Seismic Restraint (Type SS):

Design mounts to resiliently resist seismic forces in all directions. Snubbing shall take place in all modes with adjustment to limit upward, downward, and horizontal travel to a maximum of 6 mm (1/4-inch) before contacting snubbers. Mountings shall have a minimum rating of one G coefficient of gravity as calculated and certified by a registered structural engineer.

All mountings shall have leveling bolts that must be rigidly bolted to the equipment. Spring diameters shall be no less than 0.8 of the compressed height of the spring at rated load. Springs shall have a minimum additional travel to solid equal to 50 percent of the rated deflection. Mountings shall have ports for spring inspection. Provide an all directional neoprene cushion collar around the equipment bolt.

Spring Isolators with Vertical Limit Stops (Type SP): Similar to spring isolators noted above, except include a vertical limit stop to limit upward travel if weight is removed and also to reduce movement and spring extension due to wind loads. Provide clearance around restraining bolts to prevent mechanical short circuiting.

Pads (Type D), Washers (Type W), and Bushings (Type L): Pads shall be natural rubber or neoprene waffle, neoprene and steel waffle, or reinforced duck and neoprene. Washers and bushings shall be reinforced duck and neoprene. Washers and bushings shall be reinforced duck and neoprene. Size pads for a maximum load of 345 kPa (50 pounds per square inch).

Seismic Pad (Type DS): Pads shall be natural rubber / neoprene waffle with steel top plate and drilled for an anchor bolt. Washers and bushings shall be reinforced duck and neoprene. Size pads for a maximum load of 345 kPa (50 pounds per square inch).

B. Hangers: Shall be combination neoprene and springs unless otherwise noted and shall allow for expansion of pipe.

Combination Neoprene and Spring (Type H): Vibration hanger shall contain a spring and double deflection neoprene element in series. Spring shall have a diameter not less than 0.8 of compressed operating spring height. Spring shall have a minimum additional travel of 50 percent between design height and solid height. Spring shall permit a 15 degree angular misalignment without rubbing on hanger box.

Spring Position Hanger (Type HP): Similar to combination neoprene and spring hanger except hanger shall hold piping at a fixed elevation during installation and include a secondary adjustment feature to transfer load to spring while maintaining same position.

Neoprene (Type HN): Vibration hanger shall contain a double deflection type neoprene isolation element. Hanger rod shall be separated from contact with hanger bracket by a neoprene grommet.

Spring (Type HS): Vibration hanger shall contain a coiled steel spring in series with a neoprene grommet. Spring shall have a diameter not less than 0.8 of compressed operating spring height. Spring shall have a minimum additional travel of 50 percent between design height and solid height. Spring shall permit a 15 degree angular misalignment without rubbing on hanger box.

Hanger supports for piping 50 mm (2 inches) and larger shall have a pointer and scale deflection indicator.

Hangers used in seismic applications shall be provided with a neoprene and steel rebound washer installed 1/4' clear of bottom of hanger housing in operation to prevent spring from excessive upward travel

Snubbers: Each spring mounted base shall have a minimum of four all-directional or eight two directional (two per side) seismic snubbers that are double acting. Elastomeric materials shall be shock absorbent neoprene bridge quality bearing pads, maximum 60 durometer, replaceable and have a minimum thickness of 6 mm (1/4 inch). Air gap between hard and resilient material shall be not less than 3 mm (1/8 inch) nor more than 6 mm (1/4 inch). Restraints shall be capable of withstanding design load without permanent deformation.

Thrust Restraints (Type THR): Restraints shall provide a spring element contained in a steel frame with neoprene pads at each end attachment. Restraints shall have factory preset thrust and be field adjustable to allow a maximum movement of 6 mm (1/4 inch) when the fan starts and stops. Restraint assemblies shall include rods, angle brackets and other hardware for field installation.

2.4 BASES

Rails (Type R): Design rails with isolator brackets to reduce mounting height of equipment and cradle machines having legs or bases that do not require a complete supplementary base. To assure adequate stiffness, height of members shall be a minimum of 1/12 of longest base dimension but not less than 100 mm (4 inches). Where rails are used with neoprene mounts for small fans or close coupled pumps, extend rails to compensate overhang of housing.

Integral Structural Steel Base (Type B): Design base with isolator brackets to reduce mounting height of equipment which require a complete supplementary rigid base. To assure adequate stiffness, height of members shall be a minimum of 1/12 of longest base dimension, but not less than 100 mm (four inches).

Inertia Base (Type I): Base shall be a reinforced concrete inertia base. Pour concrete into a welded steel channel frame, incorporating prelocated equipment anchor bolts and pipe sleeves. Level the concrete to provide a smooth uniform bearing surface for equipment mounting. Provide grout under uneven supports. Channel depth shall be a minimum

of 1/12 of longest dimension of base but not less than 150 mm (six inches). Form shall include 13-mm (1/2-inch) reinforcing bars welded in place on minimum of 203 mm (eight inch) centers running both ways in a layer 40 mm (1-1/2 inches) above bottom. Use height saving brackets in all mounting locations. Weight of inertia base shall be equal to or greater than weight of equipment supported to provide a maximum peak-to-peak displacement of 2 mm (1/16 inch).

- D. Curb Mounted Isolation Base (Type CB): Fabricate from aluminum to fit on top of standard curb with overlap to allow water run-off and have wind and water seals which shall not interfere with spring action. Provide resilient snubbers with 6 mm (1/4 inch) clearance for wind resistance. Top and bottom bearing surfaces shall have sponge type weather seals. Integral spring isolators shall comply with Spring Isolator (Type S) requirements.

2.5 SOUND ATTENUATING UNITS

Refer to specification Section 23 31 00, HVAC DUCTS and CASINGS. PART 3 - EXECUTION

3.1 INSTALLATION

A. Vibration Isolation:

No metal-to-metal contact will be permitted between fixed and floating parts.

Connections to Equipment: Allow for deflections equal to or greater than equipment deflections. Electrical, drain, piping connections, and other items made to rotating or reciprocating equipment (pumps, compressors, etc.) which rests on vibration isolators, shall be isolated from building structure for first three hangers or supports with a deflection equal to that used on the corresponding equipment.

Common Foundation: Mount each electric motor on same foundation as driven machine. Hold driving motor and driven machine in positive rigid alignment with provision for adjusting motor alignment and belt tension. Bases shall be level throughout length and width.

Provide shims to facilitate pipe connections, leveling, and bolting. Provide heat shields where elastomers are subject to temperatures over 38 degrees C (100 degrees F).

Extend bases for pipe elbow supports at discharge and suction connections at pumps. Pipe elbow supports shall not short circuit pump vibration to structure.

6. Non-rotating equipment such as heat exchangers and convertors shall be mounted on isolation units having the same static deflection as the isolation hangers or support of the pipe connected to the equipment.

B. Inspection and Adjustments: Check for vibration and noise transmission through connections, piping, ductwork, foundations, and walls. Adjust, repair, or replace isolators as required to reduce vibration and noise transmissions to specified levels.

3.2 ADJUSTING

Adjust vibration isolators after piping systems are filled and equipment is at operating weight.

Adjust limit stops on restrained spring isolators to mount equipment at normal operating height. After equipment installation is complete, adjust limit stops so they are out of contact during normal operation.

Attach thrust limits at centerline of thrust and adjust to a maximum of 1/4inch (6-mm) movement during start and stop.

Adjust active height of spring isolators.

Adjust snubbers according to manufacturer's recommendations.

Adjust seismic restraints to permit free movement of equipment within normal mode of operation.

Torque anchor bolts according to equipment manufacturer's recommendations to resist seismic forces. -

- - E N D - - -

THIS PAGE INTENTIONALLY LEFT BLANK

SELECTION GUIDE FOR VIBRATION ISOLATORS

EQUIPMENT		ON GRADE			20FT FLOOR SPAN			30FT FLOOR SPAN			40FT FLOOR SPAN			50FT FLOOR SPAN		
		BASE TYPE	ISOL TYPE	MIN DEFL	BASE TYPE	ISOL TYPE	MIN DEFL	BASE TYPE	ISOL TYPE	MIN DEFL	BASE TYPE	ISOL TYPE	MIN DEFL	BASE TYPE	ISOL TYPE	MIN DEFL
PUMPS																
CLOSE COUPLED	UP TO 1-1/2 HP	---	---	---	---	D,L , W	---	---	D,L , W	---	---	D,L , W	---	---	D,L , W	---
	2 HP & OVER	---	---	---	I	S	0.8	I	S	1.5	I	S	1.5	I	S	2.0
LARGE INLINE	Up to 25 HP	---	---	---	---	S	0.75	---	S	1.50	---	S	1.50	---	---	NA
	26 HP THRU 30 HP	---	---	---	---	S	1.0	---	S	1.50	---	S	2.50	---	---	NA

NOTES:

Edit the Table above to suit where isolator, other than those shown, are used, such as for seismic restraints and position limit stops.

For suspended floors lighter than 100 mm (4 inch) thick concrete, select deflection requirements from next higher span.

For separate chiller building on grade, pump isolators may be omitted.

Direct bolt fire pumps to concrete base. Provide pads (D) for domestic water booster pump package.

For projects in seismic areas, use only SS & DS type isolators and snubbers.

For floor mounted in-line centrifugal blowers (ARR 1): use "B" type in lieu of "R" type base.

Suspended: Use "H" isolators of same deflection as floor mounted.

THIS PAGE INTENTIONALLY LEFT BLANK

SECTION 23 05 93
TESTING, ADJUSTING, AND BALANCING FOR HVAC

PART 1 - GENERAL

1.1 DESCRIPTION

A. Testing, adjusting, and balancing (TAB) of heating, ventilating and air conditioning (HVAC) systems. TAB includes the following:

Planning systematic TAB procedures.

Design Review Report.

Systems Inspection report.

Duct Air Leakage test report.

Systems Readiness Report.

Balancing air and water distribution systems; adjustment of total system to provide design performance; and testing performance of equipment and automatic controls.

Vibration and sound measurements.

Recording and reporting results.

B. Definitions:

Basic TAB used in this Section: Chapter 37, "Testing, Adjusting and Balancing" of 2007 ASHRAE Handbook, "HVAC Applications".

TAB: Testing, Adjusting and Balancing; the process of checking and adjusting HVAC systems to meet design objectives.

AABC: Associated Air Balance Council.

NEBB: National Environmental Balancing Bureau.

Hydronic Systems: Includes chilled water, heating hot water and glycol-water systems.

Air Systems: Includes all outside air, supply air, return air, exhaust air and relief air systems.

Flow rate tolerance: The allowable percentage variation, minus to plus, of actual flow rate from values (design) in the contract documents.

1.2 RELATED WORK

Section 23 05 11, COMMON WORK RESULTS FOR HVAC: General Mechanical Requirements.

Section 23 05 41, NOISE AND VIBRATION CONTROL FOR HVAC PIPING AND EQUIPMENT: Noise and Vibration Requirements.

Section 23 07 11, HVAC, PLUMBING, AND BOILER PLANT INSULATION: Piping and Equipment Insulation.

Section 23 64 00, PACKAGED WATER CHILLERS: Testing Refrigeration Equipment.

Section 23 36 00, AIR TERMINAL UNITS: Terminal Units Performance.

Section 23 31 00, HVAC DUCTS AND CASINGS: Duct Leakage.

Section 23 09 23, DIRECT-DIGITAL CONTROL SYSTEM FOR HVAC: Controls and Instrumentation Settings.

Section 23 82 00, CONVECTION HEATING AND COOLING UNITS

Section 23 21 23, HYDRONIC PUMPS

Section 23 37 00, AIR OUTLETS AND INLETS

Section 23 21 13, HYDRONIC PIPING

1.3 QUALITY ASSURANCE

Refer to Articles, Quality Assurance and Submittals, in Section 23 05 11, COMMON WORK RESULTS FOR HVAC.

Qualifications:

TAB Agency: The TAB agency shall be a subcontractor of the General Contractor and shall report to and be paid by the General Contractor.

The TAB agency shall be either a certified member of AABC or certified by the NEBB to perform TAB service for HVAC, water balancing and vibrations and sound testing of equipment. The certification shall be maintained for the entire duration of duties specified herein. If, for any reason, the agency loses subject certification during this period, the General Contractor shall immediately notify the COTR and submit another TAB firm for approval. Any agency that has been the subject of disciplinary action by either the AABC or the NEBB within the five years preceding Contract Award shall not be eligible to perform any work related to the TAB. All work performed in this Section and in other related Sections by the TAB agency shall be considered invalid if the TAB agency loses its certification prior to Contract completion, and the successor agency's review shows unsatisfactory work performed by the predecessor agency.

TAB Specialist: The TAB specialist shall be either a member of AABC or an experienced technician of the Agency certified by NEBB. The certification shall be maintained for the entire duration of duties specified herein. If, for any reason, the Specialist loses subject certification during this period, the General Contractor shall immediately notify the COTR and submit another TAB Specialist for

approval. Any individual that has been the subject of disciplinary action by either the AABC or the NEBB within the five years preceding Contract Award shall not be eligible to perform any duties related to the HVAC systems, including TAB. All work specified in this Section and in other related Sections performed by the TAB specialist shall be considered invalid if the TAB Specialist loses its certification prior to Contract completion and must be performed by an approved successor.

4. TAB Specialist shall be identified by the General Contractor within 60 days after the notice to proceed. The TAB specialist will be coordinating, scheduling and reporting all TAB work and related activities and will provide necessary information as required by the COTR. The responsibilities would specifically include:

Shall directly supervise all TAB work.

Shall sign the TAB reports that bear the seal of the TAB standard. The reports shall be accompanied by report forms and schematic drawings required by the TAB standard, AABC or NEBB.

Would follow all TAB work through its satisfactory completion.

Shall provide final markings of settings of all HVAC adjustment devices.

Permanently mark location of duct test ports.

5. All TAB technicians performing actual TAB work shall be experienced and must have done satisfactory work on a minimum of 3 projects comparable in size and complexity to this project. Qualifications must be certified by the TAB agency in writing. The lead technician shall be certified by AABC or NEBB

Test Equipment Criteria: The instrumentation shall meet the accuracy/calibration requirements established by AABC National Standards or by NEBB Procedural Standards for Testing, Adjusting and Balancing of Environmental Systems and instrument manufacturer. Provide calibration history of the instruments to be used for test and balance purpose.

Tab Criteria:

1. One or more of the applicable AABC, NEBB or SMACNA publications, supplemented by ASHRAE Handbook "HVAC Applications" Chapter 36, and requirements stated herein shall be the basis for planning, procedures, and reports.

2. Flow rate tolerance: Following tolerances are allowed. For tolerances not mentioned herein follow ASHRAE Handbook "HVAC Applications", Chapter 36, as a guideline. Air Filter resistance during tests, artificially imposed if necessary, shall be at least 100 percent of manufacturer recommended change over pressure drop values for pre-filters and after-filters.

Air handling unit and all other fans, cubic meters/min (cubic feet per minute): Minus 0 percent to plus 10 percent.

Air terminal units (maximum values): Minus 2 percent to plus 10 percent.

Minimum outside air: 0 percent to plus 10 percent.

Individual room air outlets and inlets, and air flow rates not mentioned above: Minus 5 percent to plus 10 percent except if the air to a space is 100 CFM or less the tolerance would be minus 5 to plus 5 percent.

Heating hot water pumps and hot water coils: Minus 5 percent to plus 5 percent.

Chilled water and condenser water pumps: Minus 0 percent to plus 5 percent.

Chilled water coils: Minus 0 percent to plus 5 percent.

3. Systems shall be adjusted for energy efficient operation as described in PART 3.
4. Typical TAB procedures and results shall be demonstrated to the COTR for one air distribution system (including all fans, three terminal units, three rooms randomly selected by the COTR) and one hydronic system (pumps and three coils) as follows:
- When field TAB work begins.
- During each partial final inspection and the final inspection for the project if requested by VA.

1.4 SUBMITTALS

Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, and SAMPLES.

Submit names and qualifications of TAB agency and TAB specialists within 60 days after the notice to proceed. Submit information on three recently completed projects and a list of proposed test equipment.

For use by the COTR staff, submit one complete set of applicable AABC or NEBB publications that will be the basis of TAB work.

Submit Following for Review and Approval:

Design Review Report within 90 days for conventional design projects after the system layout on air and water side is completed by the Contractor.

Systems inspection report on equipment and installation for conformance with design.

Duct Air Leakage Test Report.

Systems Readiness Report.

Intermediate and Final TAB reports covering flow balance and adjustments, performance tests, vibration tests and sound tests.

Include in final reports uncorrected installation deficiencies noted during TAB and applicable explanatory comments on test results that differ from design requirements.

E. Prior to request for Final or Partial Final inspection, submit completed Test and Balance report for the area.

1.5 APPLICABLE PUBLICATIONS

The following publications form a part of this specification to the extent indicated by the reference thereto. In text the publications are referenced to by the acronym of the organization.

American Society of Heating, Refrigerating and Air Conditioning Engineers, Inc. (ASHRAE):

2007 HVAC Applications ASHRAE Handbook, Chapter 37, Testing, Adjusting, and Balancing and Chapter 47, Sound and Vibration Control

Associated Air Balance Council (AABC):

2002 AABC National Standards for Total System Balance

National Environmental Balancing Bureau (NEBB):

7th Edition 2005 Procedural Standards for Testing, Adjusting, Balancing of Environmental Systems

2nd Edition 2006 Procedural Standards for the Measurement of Sound and Vibration

3rd Edition 2009Procedural Standards for Whole Building Systems Commissioning of New Construction

Sheet Metal and Air Conditioning Contractors National Association (SMACNA):

3rd Edition 2002HVAC SYSTEMS Testing, Adjusting and Balancing

PART 2 - PRODUCTS

2.1 PLUGS

Provide plastic plugs to seal holes drilled in ductwork for test purposes.

2.2 INSULATION REPAIR MATERIAL

See Section 23 07 11, HVAC and BOILER PLANT INSULATION Provide for repair of insulation removed or damaged for TAB work.

PART 3 - EXECUTION

3.1 GENERAL

Refer to TAB Criteria in Article, Quality Assurance.

Obtain applicable contract documents and copies of approved submittals for HVAC equipment and automatic control systems.

3.2 DESIGN REVIEW REPORT

The TAB Specialist shall review the Contract Plans and specifications and advise the COTR of any design deficiencies that would prevent the HVAC systems from effectively operating in accordance with the sequence of operation specified or prevent the effective and accurate TAB of the system. The TAB Specialist shall provide a report individually listing each deficiency and the corresponding proposed corrective action necessary for proper system operation.

3.3 SYSTEMS INSPECTION REPORT

Inspect equipment and installation for conformance with design.

The inspection and report is to be done after air distribution equipment is on site and duct installation has begun, but well in advance of performance testing and balancing work. The purpose of the inspection is to identify and report deviations from design and ensure that systems will be ready for TAB at the appropriate time.

Reports: Follow check list format developed by AABC, NEBB or SMACNA, supplemented by narrative comments, with emphasis on air handling units and fans. Check for conformance with submittals. Verify that diffuser and register sizes are correct. Check air terminal unit installation including their duct sizes and routing.

3.4 DUCT AIR LEAKAGE TEST REPORT

TAB Agency shall perform the leakage test as outlined in "Duct leakage Tests and Repairs" in Section 23 31 00, HVAC DUCTS and CASINGS for TAB agency's role and responsibilities in witnessing, recording and reporting of deficiencies.

3.5 SYSTEM READINESS REPORT

Inspect each System to ensure that it is complete including installation and operation of controls. Submit report to RE in standard format and forms prepared and or approved by the Commissioning Agent.

Verify that all items such as ductwork piping, ports, terminals, connectors, etc., that is required for TAB are installed. Provide a report to the COTR.

3.6 TAB REPORTS

A. The TAB contractor shall provide raw data immediately in writing to the COTR if there is a problem in achieving intended results before submitting a formal report.

3.7 TAB PROCEDURES

Tab shall be performed in accordance with the requirement of the Standard under which TAB agency is certified by either AABC or NEBB.

General: During TAB all related system components shall be in full operation. Fan and pump rotation, motor loads and equipment vibration shall be checked and corrected as necessary before proceeding with TAB. Set controls and/or block off parts of distribution systems to simulate design operation of variable volume air or water systems for test and balance work.

Allow 10 days time in construction schedule for TAB and submission of all reports for an organized and timely correction of deficiencies.

Air Balance and Equipment Test: Include air handling units, fans, terminal units, fan coil units, room diffusers/outlets/inlets.

Artificially load air filters by partial blanking to produce air pressure drop of manufacturer's recommended pressure drop.

Adjust fan speeds to provide design air flow. V-belt drives, including fixed pitch pulley requirements, are specified in Section //23 05 11, COMMON WORK RESULTS FOR HVAC.

Test and balance systems in all specified modes of operation, including variable volume, economizer, and fire emergency modes. Verify that dampers and other controls function properly.

5. Record final measurements for air handling equipment performance data sheets.

E. Water Balance and Equipment Test: Include circulating pumps, coils, coolers and condensers:

Coordinate water chiller flow balancing with Section 23 64 00, PACKAGED WATER CHILLERS.

Adjust flow rates for equipment. Set coils and evaporator to values on equipment submittals, if different from values on contract drawings.

Primary-secondary (variable volume) systems: Coordinate TAB with Section 23 09 23, DIRECT-DIGITAL CONTROL SYSTEM FOR HVAC. Balance systems at design water flow and then verify that variable flow controls function as designed.

Record final measurements for hydronic equipment on performance data sheets. Include entering and leaving water temperatures for heating and cooling coils, and for convertors. Include entering and leaving air temperatures (DB/WB for cooling coils) for air handling units and reheat coils. Make air and water temperature measurements at the same time.

3.8 VIBRATION TESTING

Furnish instruments and perform vibration measurements as specified in Section 23 05 41, NOISE and VIBRATION CONTROL FOR HVAC PIPING and EQUIPMENT. Field vibration balancing is specified in //Section 23 05 11, COMMON WORK RESULTS FOR HVAC. Provide measurements for all rotating HVAC equipment of 373 watts (1/2 horsepower) and larger, including centrifugal/screw compressors, cooling towers, pumps, fans and motors. Record initial measurements for each unit of equipment on test forms and submit a report to the COTR. Where vibration readings exceed the allowable tolerance Contractor shall be directed to correct the problem. The TAB agency shall verify that the corrections are done and submit a final report to the COTR.

3.9 SOUND TESTING

Perform and record required sound measurements in accordance with Paragraph, QUALITY ASSURANCE in Section 23 05 41, NOISE and VIBRATION CONTROL FOR HVAC PIPING and EQUIPMENT.

1. Take readings in rooms, approximately fifteen (15) percent of all rooms. The COTR may designate the specific rooms to be tested.

Take measurements with a calibrated sound level meter and octave band analyzer of the accuracy required by AABC or NEBB.

Sound reference levels, formulas and coefficients shall be according to ASHRAE Handbook, "HVAC Applications", Chapter 46, SOUND AND VIBRATION CONTROL.

Determine compliance with specifications as follows:

1. When sound pressure levels are specified, including the NC Criteria in Section 23 05 41, NOISE and VIBRATION CONTROL FOR HVAC PIPING and EQUIPMENT:

Reduce the background noise as much as possible by shutting off unrelated audible equipment.

Measure octave band sound pressure levels with specified equipment "off."

Measure octave band sound pressure levels with specified equipment "on."

Use the DIFFERENCE in corresponding readings to determine the sound pressure due to equipment.

DIFFERENCE:	0	1	2	3	4	5 to 9	10 or More
FACTOR:	10	7	4	3	2	1	0

Sound pressure level due to equipment equals sound pressure level with equipment "on" minus FACTOR.

Plot octave bands of sound pressure level due to equipment for typical rooms on a graph which also shows noise criteria (NC) curves.

2. When sound power levels are specified:

Perform steps 1.a. thru 1.d., as above.

For indoor equipment: Determine room attenuating effect, i.e., difference between sound power level and sound pressure level. Determined sound power level will be the sum of sound pressure level due to equipment plus the room attenuating effect.

For outdoor equipment: Use directivity factor and distance from noise source to determine distance factor, i.e., difference between sound power level and sound pressure level. Measured sound power level will be the sum of sound pressure level due to equipment plus the distance factor. Use 10 meters (30 feet) for sound level location.

3. Where sound pressure levels are specified in terms of dB(A), measure sound levels using the "A" scale of meter. Single value readings will be used instead of octave band analysis.

Where measured sound levels exceed specified level, the installing contractor or equipment manufacturer shall take remedial action approved by the COTR and the necessary sound tests shall be repeated. Test readings for sound testing could go higher than 15 percent if determination is made by the COTR based on the recorded sound data.

3.10 MARKING OF SETTINGS

Following approval of Tab final Report, the setting of all HVAC adjustment devices including valves, splitters and dampers shall be permanently marked by the TAB Specialist so that adjustment can be restored if disturbed at any time. Style and colors used for markings shall be coordinated with the COTR.

3.11 IDENTIFICATION OF TEST PORTS

The TAB Specialist shall permanently and legibly identify the location points of duct test ports. If the ductwork has exterior insulation, the identification shall be made on the exterior side of the insulation. All penetrations through ductwork and ductwork insulation shall be sealed to prevent air leaks and maintain integrity of vapor barrier.

3.12 PHASING

- A. Phased Projects: Testing and Balancing Work to follow project with areas shall be completed per the project phasing. Upon completion of the project all areas shall have been tested and balanced per the contract documents.

- - E N D - - -

SECTION 23 07 11
HVAC AND BOILER PLANT INSULATION

PART 1 - GENERAL

1.1 DESCRIPTION

Field applied insulation for thermal efficiency and condensation control for

1. HVAC piping, ductwork and equipment.

Definitions

1. ASJ: All service jacket, white finish facing or jacket.
2. Air conditioned space: Space having air temperature and/or humidity controlled by mechanical equipment.
3. Cold: Equipment, ductwork or piping handling media at design temperature of 16 degrees C (60 degrees F) or below.
4. Concealed: Ductwork and piping above ceilings and in chases, interstitial space, and pipe spaces.
5. Exposed: Piping, ductwork, and equipment exposed to view in finished areas including mechanical, and electrical equipment rooms or exposed to outdoor weather. Attics and crawl spaces where air handling units are located are considered to be mechanical rooms. Shafts, chases, interstitial spaces are not considered finished areas.
6. FSK: Foil-scrim-kraft facing.
7. Hot: HVAC Ductwork handling air at design temperature above 16 degrees C (60 degrees F); HVAC equipment or piping handling media above 41 degrees C (105 degrees F).
8. Density: kg/m^3 - kilograms per cubic meter (Pcf - pounds per cubic foot).
9. Runouts: Branch pipe connections up to 25-mm (one-inch) nominal size to fan coil units or reheat coils for terminal units.
10. Thermal conductance: Heat flow rate through materials.
Flat surface: Watt per square meter (BTU per hour per square foot).
Pipe or Cylinder: Watt per square meter (BTU per hour per linear foot).
11. Thermal Conductivity (k): Watt per meter, per degree C (BTU per inch thickness, per hour, per square foot, per degree F temperature difference).

Vapor Retarder (Vapor Barrier): A material which retards the transmission (migration) of water vapor. Performance of the vapor retarder is rated in terms of permeance (perms). For the purpose of this specification, vapor retarders shall have a maximum published permeance of 0.1 perms and vapor barriers shall have a maximum published permeance of 0.001 perms.

HWH: Hot water heating supply.

HWHR: Hot water heating return.

GH: Hot glycol-water heating supply.

GHR: Hot glycol-water heating return.

R: Pump recirculation.

CW: Cold water.

HW: Hot water.

CH: Chilled water supply.

CHR: Chilled water return.

PVDC: Polyvinylidene chloride vapor retarder jacketing, white.

1.2 RELATED WORK

Section 07 84 00, FIRESTOPPING: Mineral fiber and bond breaker behind sealant.

Section 23 05 11, COMMON WORK RESULTS FOR HVAC: General mechanical requirements and items, which are common to more than one section of Division 23.

C. Section 23 05 41, NOISE AND VIBRATION CONTROL FOR HVAC PIPING and EQUIPMENT

D. Section 23 21 23, HYDRONIC PUMPS

E. Section 23 21 13, HYDRONIC PIPING: Piping and equipment.

F. Section 23 21 13, HYDRONIC PIPING: Hot water, chilled water, and glycol piping.

G. Section 23 31 00, HVAC DUCTS AND CASINGS: Ductwork, plenum and fittings.

H. Section 26 32 13, ENGINE GENERATORS: Exhaust stacks and muffler.

1.3 QUALITY ASSURANCE

Refer to article QUALITY ASSURANCE, in Section 23 05 11, COMMON WORK RESULTS FOR HVAC.

Criteria:

1. Comply with NFPA 90A, particularly paragraphs 4.3.3.1 through 4.3.3.6, 4.3.10.2.6, and 5.4.6.4, parts of which are quoted as follows:

4.3.3.1 Pipe insulation and coverings, duct coverings, duct linings, vapor retarder facings, adhesives, fasteners, tapes, and supplementary materials added to air ducts, plenums, panels, and duct silencers used in duct systems, unless otherwise provided for in 4.3.3.1.1 or 4.3.3.1.2., shall have, in the form in which they are used, a maximum flame spread index of 25 without evidence of continued progressive combustion and a maximum smoke developed index of 50 when tested in accordance with NFPA 255, Standard Method of Test of Surface Burning Characteristics of Building Materials.

4.3.3.1.1 Where these products are to be applied with adhesives, they shall be tested with such adhesives applied, or the adhesives used shall have a maximum flame spread index of 25 and a maximum smoke developed index of 50 when in the final dry state. (See 4.2.4.2.)

4.3.3.1.2 The flame spread and smoke developed index requirements of 4.3.3.1.1 shall not apply to air duct weatherproof coverings where they are located entirely outside of a building, do not penetrate a wall or roof, and do not create an exposure hazard.

4.3.3.2 Closure systems for use with rigid and flexible air ducts tested in accordance with UL 181, Standard for Safety Factory-Made Air Ducts and Air Connectors, shall have been tested, listed, and used in accordance with the conditions of their listings, in accordance with one of the following:

UL 181A, Standard for Safety Closure Systems for Use with Rigid Air Ducts and Air Connectors

UL 181B, Standard for Safety Closure Systems for Use with Flexible Air Ducts and Air Connectors

4.3.3.3 Air duct, panel, and plenum coverings and linings, and pipe insulation and coverings shall not flame, glow, smolder, or smoke when tested in accordance with a similar test for pipe covering, ASTM C 411, Standard Test Method for Hot-Surface Performance of High-Temperature Thermal Insulation, at the temperature to which they are exposed in service.

4.3.3.3.1 In no case shall the test temperature be below 121°C (250°F).

4.3.3.4 Air duct coverings shall not extend through walls or floors that are required to be fire stopped or required to have a fire resistance rating, unless such coverings meet the requirements of 5.4.6.4.

4.3.3.5* Air duct linings shall be interrupted at fire dampers to prevent interference with the operation of devices.

4.3.3.6 Air duct coverings shall not be installed so as to conceal or prevent the use of any service opening.

4.3.10.2.6 Materials exposed to the airflow shall be noncombustible or limited combustibles and have a maximum smoke developed index of 50 or comply with the following.

4.3.10.2.6.1 Electrical wires and cables and optical fiber cables shall be listed as noncombustible or limited combustible and have a maximum smoke developed index of 50 or shall be listed as having a maximum peak optical density of 0.5 or less, an average optical density of 0.15 or less, and a maximum flame spread distance of 1.5 m (5 ft) or less when tested in accordance with NFPA 262, Standard Method of Test for Flame Travel and Smoke of Wires and Cables for Use in Air-Handling Spaces.

4.3.10.2.6.4 Optical-fiber and communication raceways shall be listed as having a maximum peak optical density of 0.5 or less, an average optical density of 0.15 or less, and a maximum flame spread distance of 1.5 m (5 ft) or less when tested in accordance with UL 2024, Standard for Safety Optical-Fiber Cable Raceway.

4.3.10.2.6.6 Supplementary materials for air distribution systems shall be permitted when complying with the provisions of 4.3.3.

5.4.6.4 Where air ducts pass through walls, floors, or partitions that are required to have a fire resistance rating and where fire dampers are not required, the opening in the construction around the air duct shall be as follows:

Not exceeding a 25.4 mm (1 in.) average clearance on all sides

Filled solid with an approved material capable of preventing the passage of flame and hot gases sufficient to ignite cotton waste when subjected to the time-temperature fire conditions required for fire barrier penetration as specified in *NFPA 251, Standard Methods of Tests of Fire Endurance of Building Construction and Materials*

Test methods: ASTM E84, UL 723, or NFPA 255.

Specified k factors are at 24 degrees C (75 degrees F) mean

temperature unless stated otherwise. Where optional thermal insulation material is used, select thickness to provide thermal conductance no greater than that for the specified material. For pipe, use insulation manufacturer's published heat flow tables. For domestic hot water supply and return, run out insulation and condensation control insulation, no thickness adjustment need be made.

All materials shall be compatible and suitable for service

temperature, and shall not contribute to corrosion or otherwise attack surface to which applied in either the wet or dry state. C. Every package or standard container of insulation or accessories delivered to the job site for use must have a manufacturer's stamp or label giving the name of the manufacturer and description of the material.

1.4 SUBMITTALS

A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, and SAMPLES.

B. Shop Drawings:

1. All information, clearly presented, shall be included to determine compliance with drawings and specifications and ASTM, federal and military specifications.

Insulation materials: Specify each type used and state surface burning characteristics.

Insulation facings and jackets: Each type used. Make it clear that white finish will be furnished for exposed ductwork, casings and equipment.

Insulation accessory materials: Each type used.

Manufacturer's installation and fitting fabrication instructions for flexible unicellular insulation.

Make reference to applicable specification paragraph numbers for coordination.

C. Samples:

Each type of insulation: Minimum size 100 mm (4 inches) square for board/block/ blanket; 150 mm (6 inches) long, full diameter for round types.

Each type of facing and jacket: Minimum size 100 mm (4 inches square).

Each accessory material: Minimum 120 ML (4 ounce) liquid container or 120 gram (4 ounce) dry weight for adhesives / cement / mastic. 1.5

STORAGE AND HANDLING OF MATERIAL

Store materials in clean and dry environment, pipe covering jackets shall be clean and unmarred. Place adhesives in original containers. Maintain ambient temperatures and conditions as required by printed instructions of manufacturers of adhesives, mastics and finishing cements.

1.6 APPLICABLE PUBLICATIONS

A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by basic designation only.

Federal Specifications (Fed. Spec.):

L-P-535E (2)- 99 Plastic Sheet (Sheeting): Plastic Strip; Poly
(Vinyl Chloride) and Poly (Vinyl Chloride -
Vinyl Acetate), Rigid.

Military Specifications (Mil. Spec.):

MIL-A-3316C (2)-90 Adhesives, Fire-Resistant, Thermal Insulation

MIL-A-24179A (1)-87 ... Adhesive, Flexible Unicellular-Plastic
Thermal Insulation

MIL-C-19565C (1)-88 ... Coating Compounds, Thermal Insulation, Fire-and
Water-Resistant, Vapor-Barrier

MIL-C-20079H-87 Cloth, Glass; Tape, Textile Glass; and Thread,
Glass and Wire-Reinforced Glass

American Society for Testing and Materials (ASTM):

A167-99(2004) Standard Specification for Stainless and
Heat-Resisting Chromium-Nickel Steel
Plate, Sheet, and Strip

B209-07 Standard Specification for Aluminum and
Aluminum-Alloy Sheet and Plate

C411-05 Standard test method for Hot-Surface
Performance of High-Temperature Thermal
Insulation

C449-07 Standard Specification for Mineral Fiber
Hydraulic-Setting Thermal Insulating and
Finishing Cement

C533-09 Standard Specification for Calcium Silicate
Block and Pipe Thermal Insulation

C534-08 Standard Specification for Preformed Flexible
Elastomeric Cellular Thermal Insulation in
Sheet and Tubular Form

C547-07 Standard Specification for Mineral Fiber pipe
Insulation

C552-07 Standard Specification for Cellular Glass
Thermal Insulation

C553-08 Standard Specification for Mineral Fiber
Blanket Thermal Insulation for Commercial
and Industrial Applications

- C585-09 Standard Practice for Inner and Outer Diameters
of Rigid Thermal Insulation for Nominal Sizes
of Pipe and Tubing (NPS System) R (1998)
- C612-10 Standard Specification for Mineral Fiber Block
and Board Thermal Insulation
- C1126-04 Standard Specification for Faced or Unfaced
Rigid Cellular Phenolic Thermal Insulation
- C1136-10 Standard Specification for Flexible, Low
Permeance Vapor Retarders for Thermal
Insulation
- D1668-97a (2006) Standard Specification for Glass Fabrics (Woven
and Treated) for Roofing and Waterproofing
- E84-10 Standard Test Method for Surface Burning
Characteristics of Building
Materials
- E119-09c Standard Test Method for Fire Tests of Building
Construction and Materials
- E136-09b Standard Test Methods for Behavior of Materials
in a Vertical Tube Furnace at 750 degrees C (1380
F)
- National Fire Protection Association (NFPA):
- 90A-09 Standard for the Installation of Air
Conditioning and Ventilating Systems
- 96-08 Standards for Ventilation Control and Fire
Protection of Commercial Cooking Operations
- 101-09 Life Safety Code
- 251-06 Standard methods of Tests of Fire Endurance of
Building Construction Materials
- 255-06 Standard Method of tests of Surface Burning
Characteristics of Building Materials
- Underwriters Laboratories, Inc (UL):
- 723 UL Standard for Safety Test for Surface Burning
Characteristics of Building Materials with
Revision of 09/08
- Manufacturer's Standardization Society of the Valve and Fitting
Industry (MSS):
- SP58-2009 Pipe Hangers and Supports Materials, Design,
and Manufacture

PART 2 - PRODUCTS

2.1 MINERAL FIBER OR FIBER GLASS

ASTM C612 (Board, Block), Class 1 or 2, density 48 kg/m³ (3 pcf), k = 0.037 (0.26) at 24 degrees C (75 degrees F), external insulation for temperatures up to 204 degrees C (400 degrees F) with foil scrim (FSK) facing.

ASTM C553 (Blanket, Flexible) Type I, Class B-3, Density 16 kg/m³ (1 pcf), k = 0.045 (0.31) at 24 degrees C (75 degrees F), for use at temperatures up to 204 degrees C (400 degrees F) with foil scrim (FSK) facing.

ASTM C547 (Pipe Fitting Insulation and Preformed Pipe Insulation), Class 1, k = 0.037 (0.26) at 24 degrees C (75 degrees F), for use at temperatures up to 230 degrees C (450 degrees F) with an all service vapor retarder jacket with polyvinyl chloride premolded fitting covering.

2.3 RIGID CELLULAR PHENOLIC FOAM

Preformed (molded) pipe insulation, ASTM C1126, type III, grade 1, k = 0.021(0.15) at 10 degrees C (50 degrees F), for use at temperatures up to 121 degrees C (250 degrees F) with all service vapor retarder jacket with polyvinyl chloride premolded fitting covering.

Equipment and Duct Insulation, ASTM C 1126, type II, grade 1, k = 0.021 (0.15) at 10 degrees C (50 degrees F), for use at temperatures up to 121 degrees C (250 degrees F) with rigid cellular phenolic insulation and covering, and all service vapor retarder jacket.

2.4 CELLULAR GLASS CLOSED-CELL

Comply with Standard ASTM C177, C518, density 120 kg/m³ (7.5 pcf) nominal, k = 0.033 (0.29) at 240 degrees C (75 degrees F).

Pipe insulation for use at temperatures up to 200 degrees C (400 degrees F) with all service vapor retarder jacket.

2.5 POLYISOCYANURATE CLOSED-CELL RIGID

Preformed (fabricated) pipe insulation, ASTM C591, type IV, K=0.027(0.19) at 24 degrees C (75 degrees F), flame spread not over 25, smoke developed not over 50, for use at temperatures up to 149 degree C (300 degree F) with factory applied PVDC or all service vapor retarder jacket with polyvinyl chloride premolded fitting covers.

Equipment and duct insulation, ASTM C 591, type IV, K=0.027(0.19) at 24 degrees C (75 degrees F), for use at temperatures up to 149 degrees C (300 degrees F) with PVDC or all service jacket vapor retarder jacket.

2.6 FLEXIBLE ELASTOMERIC CELLULAR THERMAL

ASTM C177, C518, $k = 0.039$ (0.27) at 24 degrees C (75 degrees F), flame spread not over 25, smoke developed not over 50, for temperatures from minus 4 degrees C (40 degrees F) to 93 degrees C (200 degrees F). No jacket required.

2.7 INSULATION FACINGS AND JACKETS

Vapor Retarder, higher strength with low water permeance 0.02 or less perm rating, Beach puncture 50 units for insulation facing on exposed ductwork, casings and equipment, and for pipe insulation jackets. Facings and jackets shall be all service type (ASJ) or PVDC Vapor Retarder jacketing.

ASJ jacket shall be white kraft bonded to 0.025 mm (1 mil) thick aluminum foil, fiberglass reinforced, with pressure sensitive adhesive closure. Comply with ASTM C1136. Beach puncture 50 units, Suitable for painting without sizing. Jackets shall have minimum 40 mm (1-1/2 inch) lap on longitudinal joints and minimum 75 mm (3 inch) butt strip on end joints. Butt strip material shall be same as the jacket. Lap and butt strips shall be self-sealing type with factory-applied pressure sensitive adhesive.

Vapor Retarder medium strength with low water vapor permeance of 0.02 or less perm rating), Beach puncture 25 units: Foil-Scrim-Kraft (FSK) or PVDC vapor retarder jacketing type for concealed ductwork and equipment.

Field applied vapor barrier jackets shall be provided, in addition to the specified facings and jackets, on all exterior piping and ductwork as well as on interior piping and ductwork. The vapor barrier jacket shall consist of a multi-layer laminated cladding with a maximum water vapor permeance of 0.001 perms. The minimum puncture resistance shall be 35 cm-kg (30 inch-pounds) for interior locations and 92 cm-kg (80 inch-pounds) for exterior or exposed locations or where the insulation is subject to damage.

Glass Cloth Jackets: Presized, minimum 0.18 kg per square meter (7.8 ounces per square yard), 2000 kPa (300 psig) bursting strength with integral vapor retarder where required or specified. Weather proof if utilized for outside service.

Factory composite materials may be used provided that they have been tested and certified by the manufacturer.

Pipe fitting insulation covering (jackets): Fitting covering shall be premolded to match shape of fitting and shall be polyvinyl chloride (PVC) conforming to Fed Spec L-P-335, composition A, Type II Grade GU, and Type III, minimum thickness 0.7 mm (0.03 inches). Provide color matching vapor retarder pressure sensitive tape.

Aluminum Jacket-Piping systems: ASTM B209, 3003 alloy, H-14 temper, 0.6 mm (0.023 inch) minimum thickness with locking longitudinal joints.

Jackets for elbows, tees and other fittings shall be factory-fabricated to match shape of fitting and of 0.6 mm (0.024) inch minimum thickness aluminum. Fittings shall be of same construction as straight run jackets but need not be of the same alloy. Factory-fabricated

stainless steel bands shall be installed on all circumferential joints. Bands shall be 13 mm (0.5 inch) wide on 450 mm (18 inch) centers.

System shall be weatherproof if utilized for outside service.

2.8 PIPE COVERING PROTECTION SADDLES

Cold pipe support: Premolded pipe insulation 180 degrees (half-shells) on bottom half of pipe at supports. Material shall be cellular glass or high density Polyisocyanurate insulation of the same thickness as adjacent insulation. Density of Polyisocyanurate insulation shall be a minimum of 48 kg/m³ (3.0 pcf).

Nominal Pipe Size and Accessories Material (Insert Blocks)	
Nominal Pipe Size mm (inches)	Insert Blocks mm (inches)
Up through 125 (5)	150 (6) long
150 (6)	150 (6) long
200 (8), 250 (10), 300 (12)	225 (9) long
350 (14), 400 (16)	300 (12) long
450 through 600 (18 through 24)	350 (14) long

Warm or hot pipe supports: Premolded pipe insulation (180 degree half-shells) on bottom half of pipe at supports. Material shall be high density Polyisocyanurate (for temperatures up to 149 degrees C [300 degrees F]), cellular glass or calcium silicate. Insulation at supports shall have same thickness as adjacent insulation. Density of Polyisocyanurate insulation shall be a minimum of 48 kg/m³ (3.0 pcf).

2.9 ADHESIVE, MASTIC, CEMENT

Mil. Spec. MIL-A-3316, Class 1: Jacket and lap adhesive and protective finish coating for insulation.

Mil. Spec. MIL-A-3316, Class 2: Adhesive for laps and for adhering insulation to metal surfaces.

Mil. Spec. MIL-A-24179, Type II Class 1: Adhesive for installing flexible unicellular insulation and for laps and general use.

Mil. Spec. MIL-C-19565, Type I: Protective finish for outdoor use.

Mil. Spec. MIL-C-19565, Type I or Type II: Vapor barrier compound for indoor use.

ASTM C449: Mineral fiber hydraulic-setting thermal insulating and finishing cement.

Other: Insulation manufacturers' published recommendations.

2.10 MECHANICAL FASTENERS

Pins, anchors: Welded pins, or metal or nylon anchors with galvanized steel-coated or fiber washer, or clips. Pin diameter shall be as recommended by the insulation manufacturer.

Staples: Outward clinching galvanized steel.

Wire: 1.3 mm thick (18 gage) soft annealed galvanized or 1.9 mm (14 gage) copper clad steel or nickel copper alloy.

Bands: 13 mm (0.5 inch) nominal width, brass, galvanized steel, aluminum or stainless steel.

2.11 REINFORCEMENT AND FINISHES

Glass fabric, open weave: ASTM D1668, Type III (resin treated) and Type I (asphalt treated).

Glass fiber fitting tape: Mil. Spec MIL-C-20079, Type II, Class 1.

Tape for Flexible Elastomeric Cellular Insulation: As recommended by the insulation manufacturer.

Hexagonal wire netting: 25 mm (one inch) mesh, 0.85 mm thick (22 gage) galvanized steel.

Corner beads: 50 mm (2 inch) by 50 mm (2 inch), 0.55 mm thick (26 gage) galvanized steel; or, 25 mm (1 inch) by 25 mm (1 inch), 0.47 mm thick (28 gage) aluminum angle adhered to 50 mm (2 inch) by 50 mm (2 inch) Kraft paper.

F. PVC fitting cover: Fed. Spec L-P-535, Composition A, 11-86 Type II, Grade GU, with Form B Mineral Fiber insert, for media temperature 4 degrees C (40 degrees F) to 121 degrees C (250 degrees F). Below 4 degrees C (40 degrees F) and above 121 degrees C (250 degrees F). Provide double layer insert. Provide color matching vapor barrier pressure sensitive tape.

2.12 FIRESTOPPING MATERIAL

Other than pipe and duct insulation, refer to Section 07 84 00 FIRESTOPPING.

2.13 FLAME AND SMOKE

Unless shown otherwise all assembled systems shall meet flame spread 25 and smoke developed 50 rating as developed under ASTM, NFPA and UL standards and specifications. See paragraph 1.3 "Quality Assurance".

PART 3 - EXECUTION

3.1 GENERAL REQUIREMENTS

Required pressure tests of duct and piping joints and connections shall be completed and the work approved by the COTR for application of insulation. Surface shall be clean and dry with all foreign materials, such as dirt, oil, loose scale and rust removed.

Except for specific exceptions, insulate entire specified equipment, piping (pipe, fittings, valves, accessories), and duct systems. Insulate each pipe and duct individually. Do not use scrap pieces of insulation where a full length section will fit.

Insulation materials shall be installed in a first class manner with smooth and even surfaces, with jackets and facings drawn tight and smoothly cemented down at all laps. Insulation shall be continuous through all sleeves and openings, except at fire dampers and duct heaters (NFPA 90A). Vapor retarders shall be continuous and uninterrupted throughout systems with operating temperature 16 degrees C (60 degrees F) and below. Lap and seal vapor retarder over ends and exposed edges of insulation. Anchors, supports and other metal projections through insulation on cold surfaces shall be insulated and vapor sealed for a minimum length of 150 mm (6 inches).

Install vapor stops at all insulation terminations on either side of valves, pumps and equipment and particularly in straight lengths of pipe insulation.

- E. Construct insulation on parts of equipment such as chilled water pumps and heads of chillers, convertors and heat exchangers that must be opened periodically for maintenance or repair, so insulation can be removed and replaced without damage. Install insulation with bolted 1 mm thick (20 gage) galvanized steel or aluminum covers as complete units, or in sections, with all necessary supports, and split to coincide with flange/split of the equipment.
- F. Insulation on hot piping and equipment shall be terminated square at items not to be insulated, access openings and nameplates. Cover all exposed raw insulation with white sealer or jacket material.
- G. Protect all insulations outside of buildings with aluminum jacket using lock joint or other approved system for a continuous weather tight system. Access doors and other items requiring maintenance or access shall be removable and sealable.
- H. HVAC work not to be insulated:
Internally insulated ductwork and air handling units.
Exhaust air ducts and plenums, and ventilation exhaust air shafts.
Equipment: Expansion tanks, flash tanks, hot water pumps.
In hot piping: Unions, flexible connectors, control valves, PRVs, safety valves and discharge vent piping, vacuum breakers, thermostatic vent valves. Insulate piping to within approximately 75 mm (3 inches) of uninsulated items.
- I. Apply insulation materials subject to the manufacturer's recommended temperature limits. Apply adhesives, mastic and coatings at the manufacturer's recommended minimum coverage.
- J. Elbows, flanges and other fittings shall be insulated with the same material as is used on the pipe straights. The elbow/ fitting insulation shall be field-fabricated, mitered or factory prefabricated to the necessary size and shape to fit on the elbow/ fitting. Use of polyurethane spray-foam to fill a PVC elbow jacket is prohibited on cold applications.
- K. Firestop Pipe and Duct insulation:
1. Provide firestopping insulation at fire and smoke barriers through penetrations. Fire stopping insulation shall be UL listed as defines in Section 07 84 00, FIRESTOPPING.

2. Pipe and duct penetrations requiring fire stop insulation including, but not limited to the following:

Pipe risers through floors
 Pipe or duct chase walls and floors
 Smoke partitions
 Fire partitions

Freeze protection of above grade outdoor piping (over heat tracing tape):

26 mm (10 inch) thick insulation, for all pipe sizes 75 mm(3 inches) and smaller and 25 mm(1inch) thick insulation for larger pipes. Provide metal jackets for all pipes. Provide for cold water make-up to chilled water piping as described in Section 23 21 13, HYDRONIC PIPING (electrical heat tracing systems).

Provide vapor barrier jackets over insulation as follows: 1.

All piping and ductwork exposed to outdoor weather.

Provide metal jackets over insulation as follows:

All piping and ducts exposed to outdoor weather.

Piping exposed in building, within 1800 mm (6 feet) of the floor, that connects to kitchen and laundry equipment. Jackets may be applied with pop rivets. Provide aluminum angle ring escutcheons at wall, ceiling or floor penetrations.

A 50 mm (2 inch) overlap is required at longitudinal and circumferential joints.

3.2 INSULATION INSTALLATION

A. Mineral Fiber Board:

Faced board: Apply board on pins spaced not more than 300 mm (12 inches) on center each way, and not less than 75 mm (3 inches) from each edge of board. In addition to pins, apply insulation bonding adhesive to entire underside of horizontal metal surfaces. Butt insulation edges tightly and seal all joints with laps and butt strips. After applying speed clips cut pins off flush and apply vapor seal patches over clips.

Plain board:

- a. Insulation shall be scored, beveled or mitered to provide tight joints and be secured to equipment with bands spaced 225 mm (9 inches) on center for irregular surfaces or with pins and clips on flat surfaces. Use corner beads to protect edges of insulation.

For hot equipment: Stretch 25 mm (1 inch) mesh wire, with edges wire laced together, over insulation and finish with insulating and finishing cement applied in one coat, 6 mm (1/4 inch) thick, trowel led to a smooth finish.

For cold equipment: Apply meshed glass fabric in a tack coat 1.5 to 1.7 square meter per liter (60 to 70 square feet per gallon) of vapor mastic and finish with mastic at 0.3 to 0.4 square meter per liter (12 to 15 square feet per gallon) over the entire fabric surface.

Chilled water pumps: Insulate with removable and replaceable 1 mm thick (20 gage) aluminum or galvanized steel covers lined with insulation. Seal closure joints/flanges of covers with gasket material. Fill void space in enclosure with flexible mineral fiber insulation.

3. Exposed, unlined ductwork and equipment in unfinished areas, mechanical and electrical equipment rooms and attics, and duct work exposed to outdoor weather.
 - a. Exposed, unlined supply and return ductwork exposed to outdoor weather: 50 mm (2 inch) thick insulation faced with a reinforcing membrane and two coats of vapor barrier mastic or multi-layer vapor barrier with a maximum water vapor permeability of 0.001 perms.
4. Cold equipment: 40 mm (1-1/2 inch) thick insulation faced with ASJ. Chilled water pumps, water filter, chemical feeder pot or tank. Cold storage water and surge tanks.
5. Hot equipment: 40 mm (1-1/2 inch) thick insulation faced with ASJ. Reheat coil casing and separation chambers on steam humidifiers located above ceilings. Domestic water heaters and hot water storage tanks (not factory insulated).

B. Flexible Mineral Fiber Blanket:

1. Adhere insulation to metal with 75 mm (3 inch) wide strips of insulation bonding adhesive at 200 mm (8 inches) on center all around duct. Additionally secure insulation to bottom of ducts exceeding 600 mm (24 inches) in width with pins welded or adhered on 450 mm (18 inch) centers. Secure washers on pins. Butt insulation edges and seal joints with laps and butt strips. Staples may be used to assist in securing insulation. Seal all vapor retarder

penetrations with mastic. Sagging duct insulation will not be acceptable. Install firestop duct insulation where required.

2. Supply air ductwork to be insulated includes main and branch ducts from AHU discharge to room supply outlets, and the bodies of ceiling outlets to prevent condensation. Insulate sound attenuator units, coil casings and damper frames. To prevent condensation insulate trapeze type supports and angle iron hangers for flat oval ducts that are in direct contact with metal duct.

3. Concealed supply air ductwork.

Above ceilings at a roof level, in attics, and duct work exposed to outdoor weather: 50 mm (2 inch) thick insulation faced with FSK. Above ceilings for other than roof level: 40 mm (1 1/2 inch) thick insulation faced with FSK.

4. Concealed return air duct:

Above ceilings at a roof level, unconditioned areas, and in chases with external wall or containing steam piping; 40 mm (1 1/2 inch) thick, insulation faced with FSK.

In interstitial spaces (where not subject to damage): 40 mm (1 1/2 inch) thick insulation faced with FSK.

Concealed return air ductwork in other locations need not be insulated.

C. Molded Mineral Fiber Pipe and Tubing Covering:

Fit insulation to pipe or duct, aligning longitudinal joints. Seal longitudinal joint laps and circumferential butt strips by rubbing hard with a nylon sealing tool to assure a positive seal. Staples may be used to assist in securing insulation. Seal all vapor retarder penetrations on cold piping with a generous application of vapor barrier mastic. Provide inserts and install with metal insulation shields at outside pipe supports. Install freeze protection insulation over heating cable.

Contractor's options for fitting, flange and valve insulation:

Insulating and finishing cement for sizes less than 100 mm (4 inches) operating at surface temperature of 16 degrees C (61 degrees F) or more.

Factory premolded, one piece PVC covers with mineral fiber, (Form B), inserts. Provide two insert layers for pipe temperatures below 4 degrees C (40 degrees F), or above 121 degrees C (250

degrees F). Secure first layer of insulation with twine. Seal seam edges with vapor barrier mastic and secure with fitting tape.

Factory molded, ASTM C547 or field mitered sections, joined with adhesive or wired in place. For hot piping finish with a smoothing coat of finishing cement. For cold fittings, 16 degrees C (60 degrees F) or less, vapor seal with a layer of glass fitting tape imbedded between two 2 mm (1/16 inch) coats of vapor barrier mastic.

Fitting tape shall extend over the adjacent pipe insulation and overlap on itself at least 50 mm (2 inches).

Nominal thickness in millimeters and inches specified in the schedule at the end of this section.

D. Rigid Cellular Phenolic Foam:

Rigid closed cell phenolic insulation may be provided for piping, ductwork and equipment for temperatures up to 121 degrees C (250 degrees F).

Note the NFPA 90A burning characteristics requirements of 25/50 in paragraph 1.3.B

Provide secure attachment facilities such as welding pins.

Apply insulation with joints tightly drawn together

Apply adhesives, coverings, neatly finished at fittings, and valves.

Final installation shall be smooth, tight, neatly finished at all edges.

Minimum thickness in millimeters (inches) specified in the schedule at the end of this section.

Exposed, unlined supply and return ductwork exposed to outdoor weather: 50 mm (2 inch) thick insulation faced with a multi-layer vapor barrier with a maximum water vapor permeance of 0.00 perms.

Condensation control insulation: Minimum 25 mm (1.0 inch) thick for all pipe sizes.

- a. HVAC: Cooling coil condensation piping to waste piping fixture or drain inlet. Omit insulation on plastic piping in mechanical rooms.

E. Cellular Glass Insulation:

Pipe and tubing, covering nominal thickness in millimeters and inches as specified in the schedule at the end of this section.

Underground Piping Other than or in lieu of that Specified in Section 23 21 13, HYDRONIC PIPING: Type II, factory jacketed with a

3 mm laminate jacketing consisting of 3000 mm x 3000 mm (10 ft x 10 ft) asphalt impregnated glass fabric, bituminous mastic and outside protective plastic film.

- a. 75 mm (3 inches) thick for hot water piping.
- b. As scheduled at the end of this section for chilled water piping.
- c. Underground piping: Apply insulation with joints tightly butted. Seal longitudinal self-sealing lap. Use field fabricated or factory made fittings. Seal butt joints and fitting with jacketing as recommended by the insulation manufacturer. Use 100 mm (4 inch) wide strips to seal butt joints.
- d. Provide expansion chambers for pipe loops, anchors and wall penetrations as recommended by the insulation manufacturer.
- e. Underground insulation shall be inspected and approved by the COTR as follows:

Insulation in place before coating.

After coating.

- f. Sand bed and backfill: Minimum 75 mm (3 inches) all around insulated pipe or tank, applied after coating has dried.

Cold equipment: 50 mm (2 inch) thick insulation faced with ASJ for chilled water pumps, water filters, chemical feeder pots or tanks, expansion tanks, air separators and air purgers.

Exposed, unlined supply and return ductwork exposed to outdoor weather: 50 mm (2 inch) thick insulation faced with a reinforcing membrane and two coats of vapor barrier mastic or multi-layer vapor barrier with a water vapor permeability of 0.00 perms.

F. Polyisocyanurate Closed-Cell Rigid Insulation:

Polyisocyanurate closed-cell rigid insulation (PIR) may be provided for exterior piping, equipment and ductwork for temperature up to 149 degree C (300 degree F).

Install insulation, vapor barrier and jacketing per manufacturer's recommendations. Particular attention should be paid to recommendations for joint staggering, adhesive application, external hanger design, expansion/contraction joint design and spacing and vapor barrier integrity.

Install insulation with all joints tightly butted (except expansion joints in hot applications).

If insulation thickness exceeds 63 mm (2.5 inches), install as a double layer system with longitudinal (lap) and butt joint staggering as recommended by manufacturer.

For cold applications, vapor barrier shall be installed in a continuous manner. No staples, rivets, screws or any other attachment device capable of penetrating the vapor barrier shall be used to attach the vapor barrier or jacketing. No wire ties capable of penetrating the vapor barrier shall be used to hold the insulation in place. Banding shall be used to attach PVC or metal jacketing.

Elbows, flanges and other fittings shall be insulated with the same material as is used on the pipe straights. The elbow/ fitting insulation shall be field-fabricated, mitered or factory prefabricated to the necessary size and shape to fit on the elbow/ fitting. Use of polyurethane spray-foam to fill PVC elbow jacket is prohibited on cold applications.

For cold applications, the vapor barrier on elbows/fittings shall be either mastic-fabric-mastic or 2 mil thick PVDC vapor barrier adhesive tape.

All PVC and metal jacketing shall be installed so as to naturally shed water. Joints shall point down and shall be sealed with either adhesive or caulking (except for periodic slip joints).

Underground piping: Follow instructions for above ground piping but the vapor retarder jacketing shall be 6 mil thick PVDC or minimum 30 mil thick rubberized bituminous membrane. Sand bed and backfill shall be a minimum of 150 mm (6 inches) all around insulated pipe.

Exposed, unlined supply and return ductwork exposed to outdoor weather: 50 mm (2 inch) thick insulation faced with a multi-layer vapor barrier with a water vapor permeance of 0.00 perms.

Note the NFPA 90A burning characteristic requirements of 25/50 in paragraph 1.3B. Refer to paragraph 3.1 for items not to be insulated.

Minimum thickness in millimeter (inches) specified in the schedule at the end of this section.

G. Flexible Elastomeric Cellular Thermal Insulation:

1. Apply insulation and fabricate fittings in accordance with the manufacturer's installation instructions and finish with two coats of weather resistant finish as recommended by the insulation manufacturer.

2. Pipe and tubing insulation:

Use proper size material. Do not stretch or strain insulation.

To avoid undue compression of insulation, provide cork stoppers or wood inserts at supports as recommended by the insulation manufacturer. Insulation shields are specified under Section 23 05 11, COMMON WORK RESULTS FOR HVAC.

Where possible, slip insulation over the pipe or tubing prior to connection, and seal the butt joints with adhesive. Where the slip-on technique is not possible, slit the insulation and apply it to the pipe sealing the seam and joints with contact adhesive. Optional tape sealing, as recommended by the manufacturer, may be employed. Make changes from mineral fiber insulation in a straight run of pipe, not at a fitting. Seal joint with tape.

3. Apply sheet insulation to flat or large curved surfaces with 100 percent adhesive coverage. For fittings and large pipe, apply adhesive to seams only.
4. Pipe insulation: nominal thickness in millimeters (inches as specified in the schedule at the end of this section.
5. Minimum 20 mm (0.75 inch) thick insulation for pneumatic control lines for a minimum distance of 6 m (20 feet) from discharge side of the refrigerated dryer.
6. Use Class S (Sheet), 20 mm (3/4 inch) thick for the following:
Chilled water pumps
Bottom and sides of metal basins for winterized cooling towers (where basin water is heated).
Chillers, insulate any cold chiller surfaces subject to condensation which has not been factory insulated.
7. Exposed, unlined supply and return ductwork exposed to outdoor weather: 50 mm (2 inch) thick insulation faced with a multi-layer vapor barrier with a water vapor permeance of 0.00 perms.

3.3 PIPE INSULATION SCHEDULE

Provide insulation for piping systems as scheduled below:

Insulation Thickness Millimeters (Inches)					
Operating Temperature Range/Service	Insulation Material	Nominal Pipe Size Millimeters (Inches)			
		Less than 25 (1)	25 - 32 (1 - 1¼)	38 - 75 (1½ - 3)	100 (4) and Above
38-94 degrees C (100-200 degrees F) (LPR, PC, HWH, HWHR, GH and GHR)	Mineral Fiber (Above ground piping only)	38 (1.5)	38 (1.5)	50 (2.0)	50 (2.0)
38-99 degrees C (100-211 degrees F) (LPR, PC, HWH, HWHR, GH and GHR)	Rigid Cellular Phenolic Foam	38 (1.5)	38 (1.5)	50 (2.0)	50 (2.0)
39-99 degrees C (100-211 degrees F) (LPR, PC, HWH, HWHR, GH and GHR)	Polyisocyanurate Closed-Cell Rigid (Exterior Locations only)	38 (1.5)	38 (1.5)	----	—
38-94 degrees C (100-200 degrees F) (LPR, PC, HWH, HWHR, GH and GHR)	Flexible Elastomeric Cellular Thermal (Above ground piping only)	38 (1.5)	38 (1.5)	----	—
4-16 degrees C (40-60 degrees F) (CH, CHR, GC, GCR and RS for DX refrigeration)	Rigid Cellular Phenolic Foam	38 (1.5)	38 (1.5)	38 (1.5)	38 (1.5)
4-16 degrees C (40-60 degrees F) (CH and CHR within chiller room and pipe chase and underground)	Cellular Glass Closed-Cell	50 (2.0)	50 (2.0)	75 (3.0)	75 (3.0)
4-16 degrees C (40-60 degrees F) (CH, CHR, GC, GCR and RS for DX refrigeration)	Cellular Glass Closed-Cell	38 (1.5)	38 (1.5)	38 (1.5)	38 (1.5)

4-16 degrees C (40-60 degrees F) (CH, CHR, GC and GCR (where underground))	Polyiso- cyanurate Closed-Cell Rigid	38 (1.5)	38 (1.5)	50 (2.0)	50 (2.0)
4-16 degrees C (40-60 degrees F) (CH, CHR, GC, GCR and RS for DX refrigeration)	Polyiso- cyanurate Closed-Cell Rigid (Exterior Locations only)	38 (1.5)	38 (1.5)	38 (1.5)	38 (1.5)
(40-60 degrees F) (CH, CHR, GC, GCR and RS for DX refrigeration)	Flexible Elastomeric Cellular Thermal (Above ground piping only)	38 (1.5)	38 (1.5)	38 (1.5)	38 (1.5)

- - - E N D - - -

SECTION 23 08 00

COMMISSIONING OF HVAC SYSTEMS

PART 1 - GENERAL

1.1 DESCRIPTION

The requirements of this Section apply to all sections of Division 23. This project will have selected building systems commissioned. The complete list of equipment and systems to be commissioned are specified in Section 01 91 00 GENERAL COMMISSIONING REQUIREMENTS. The commissioning process, which requires participation of the Contractor, is defined in Section 01 91 00 GENERAL COMMISSIONING REQUIREMENTS. A Commissioning Agent (CxA) appointed by the Department of Veterans Affairs will manage the commissioning process.

1.2 RELATED WORK

Section 01 00 00 GENERAL REQUIREMENTS.

Section 01 91 00 GENERAL COMMISSIONING REQUIREMENTS.

Section 01 33 23 SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

1.3 REFERENCES

A. Project Commissioning Plan

A separate document, titled "Project Commissioning Plan" describes additional detailed requirements for the systems commissioning work. The Project Commissioning Plan shall be considered integral with these specifications, and a part of the project manual and construction contract documents.

The contractor shall become thoroughly knowledgeable of the requirements of the Project Commissioning Plan, all project specifications, and the project drawings, and shall coordinate the work of all trades in the provision of the commissioning services.

B. Project Specifications

1. Various sections of the project specifications require equipment start-up, testing, and adjusting services. Requirements for startup, testing, and adjusting services specified in the 15000 series sections of these specifications are intended to be provided in coordination with the commissioning services and are not intended to duplicate services. The contractor shall coordinate the work required by individual specification sections with the commissioning services requirements specified herein.

Where individual testing, adjusting, or related services are required in the project specifications and not specifically required by this commissioning specification, or the Project Commissioning Plan, the specified services shall be provided and copies of documentation, as required by those specifications, shall be supplied to the CxA and attached to the related sections of the completed project commissioning plan, and indexed for future reference.

Where Owner training or educational services are required and specified in the 15000 series sections of the specification, these services are intended to be provided in addition to the training and educational services specified herein and in the Project Commissioning Plan. The CxA shall review the Prime Contractor's and installing subcontractor's training plan to develop and ensure effective contractor manufacturing plans. The CxA will provide subsequent training including:

- Review of system design, capacity, efficiency and equipment selection.

- Review of system operating sequences.

- Review of interconnection with other systems if applicable.

- Review of Emergency operating procedures.

- Review of the Project systems manual and its use.

The training provided by the CxA does not in any way relieve the Contractor from any specified training obligations.

1.4 SUMMARY

This Section includes requirements for commissioning the HVAC systems, subsystems and equipment. This Section supplements the general requirements specified in Section 01 91 00 GENERAL COMMISSIONING REQUIREMENTS.

The commissioning activities have been developed to support the VA requirements to meet guidelines for Federal Leadership in Environmental, Energy, and Economic Performance.

The Contractor shall fully review all commissioning checks, tests, and procedures, and related sequencing requirements, provided in the Project Commissioning Plan, and become thoroughly knowledgeable of all commissioning procedure requirements. The Contractor shall thoroughly review all procedures with the respective equipment manufacturers to determine that the procedures can be provided in a manner which fully

protects the equipment, the construction staff, the commissioning team members, and which maintains full equipment warranties and guarantees. The Contractor shall be fully responsible for all means, methods, and materials, required to ensure adequate job-site safety. The Contractor shall modify the commissioning procedures provided in the Project Commissioning Plan as required to adequately reflect the requirements for job-site safety and adequate protection of the systems and equipment.

The Contractor shall modify the commissioning procedures as required to coordinate all scheduling and sequencing requirements.

The Contractor shall modify the commissioning procedures as required to adequately reflect the actual conditions, equipment, and systems, as installed.

The Contractor shall add checking, testing, or operational procedures as may be deemed necessary by the Contractor, or by the equipment manufacturers, to fully demonstrate that the equipment or system is adequately installed and fully functional.

The Contractor shall add checking, testing, or operational procedures as necessary to provide a fully coordinated construction and commissioning effort and to provide the commissioning sequencing requirements.

The Contractor shall add, duplicate, or otherwise provide sufficient procedure forms as necessary to provide sufficient space to record all required information for each component item and system included in the procedure. This effort shall be coordinated with the Commissioning Agent. All procedure forms shall clearly indicate equipment identification numbers and descriptions coordinated with the Owner's identification system. All procedure tasks or elements shall have provision within the forms to include the procedure results directly within the computer program electronic file copy without modification of the forms or data sheets.

Contractor modifications and additions to the commissioning procedures shall be fully annotated to indicate the specific changes and the reasons for the each change. Additions and modifications to the commissioning procedures shall be subject to review and approval by the CxA.

All commissioning procedures shall include a specific team listing of all individuals participating in each procedure and their respective

organizations or roles. Provide space for each participant to sign as verification of attendance only. Personnel signatures provided by participants, including the CxM, CxA, and OXRs shall not constitute acceptance of the procedure, equipment, or system.

Submit each final commissioning procedure to the CxA for review and approval. Individual procedures, or sets of procedures, related to a specific commissioning phase or system shall be grouped as an individual submittal. Where a specific procedure will be applied multiple times for specific components or repetitive equipment or system items, the procedure may be submitted in generic form provided with appropriate explanation of the intended methods of record keeping and system identification approach. All procedures and procedure forms shall be submitted in single sided hard copy with the Architects submittal review stamp applied to the back side of the sheet. Procedures shall not be scheduled for completion prior to obtaining satisfactory review and approval by the CxA.

The CxM or designated assistant, as elected by the contractor shall provide all field record keeping of all procedure results. All field data, notes, and comments, shall be neatly hand labeled in the respective procedure forms during each procedure. A dated copy of the completed hand labeled form with all participant signatures shall be provided to each participant by the CxM. The CxM shall maintain a master file of all completed procedure originals and shall attach one copy of all original field annotated procedure forms to the final Commissioning Plan. The CxM shall transfer all field procedure results, comments, and annotations to the computerized file copy of the procedure and shall distribute one hard copy of the completed procedure form to each participant. Signature spaces shall be annotated as "yes" or "no" as verification of attendance in the computerized file copies.

Refer to Section 01 91 00 GENERAL COMMISSIONING REQUIREMENTS for more specifics regarding processes and procedures as well as roles and responsibilities for all Commissioning Team members.

1.5 DEFINITIONS

A. Refer to Section 01 91 00 GENERAL COMMISSIONING REQUIREMENTS for definitions.

1.6 COMMISSIONED SYSTEMS

A. Commissioning of a system or systems specified in this Division is part of the construction process. Documentation and testing of these

systems, as well as training of the VA's Operation and Maintenance personnel, is required in cooperation with the VA and the Commissioning Agent.

B. The following HVAC systems will be commissioned:

Air Handling Systems (including terminal units and energy recovery units)

Air Handling Systems (Fans, motors, Variable Speed Drives, cooling coils and control valves, heating coils and control valves, filters, dampers, safeties such as smoke detectors or freezestats and damper end switches, controls, gages, and vibration isolation).

Dehumidification Systems (Energy recovery devices - such as enthalpy wheels, fans, motors, Variable Speed Drives, cooling coils and control valves, heating coils and control valves, filters, dampers, safeties, controls, gages, and vibration isolation).

6. Chilled Water Systems (Chilled water pumps and motors, Variable Speed Drives, chiller motor/compressor, controls, instrumentation and safeties, isolation valves, blending valves, side stream water cleaners/scrubbers/filters).

Exhaust Fans (Fan, motor, Variable Speed Drives, controls and safeties).

Heating Hot Water System System (Boilers, controls, gages and instrumentation, safety relief valves, combustion burners/fans/motors, fuel delivery pumps and motors, flues).

Pumps and Variable Speed Drives

Direct Digital Control System (BACnet or similar Local Area Network (LAN), Operator Work Station hardware and software, building controller hardware and software, terminal unit controller hardware and software, all sequences of operation, system accuracy and response time).

HVAC Water Treatment Systems (Closed circuits - including shot feeders and final water analysis, open circuits - including water analysis, chemical/biocide tanks, injection piping, chemical/biocide pumps and motors, controls, water meter, and automatic blowdown).

1.7 SUBMITTALS

A. The commissioning process requires review of selected Submittals.

Submittals for all systems listed in section 1.6.B shall be provided to the CxA such that the CxA may review these submittals in parallel with

the A/E team. Refer to Section 01 33 23 SHOP DRAWINGS, PRODUCT DATA, and SAMPLES for further details.

- B. The commissioning process requires Submittal review simultaneously with engineering review. Specific submittal requirements related to the commissioning process are specified in Section 01 91 00 GENERAL COMMISSIONING REQUIREMENTS.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.1 PRE-COMMISSIONING WORK SESSION

The Contractor's CxM shall schedule and chair a pre-commissioning work session. The work session shall be held prior to the initial submittals of the Commissioning Plan at a time when the CxA has developed the plan to at least 50% completion.

The work session shall be held at the Contractor's principle place of business. The CxM, CxA, OxA, the Contractor's project manager, Contractor's designated construction superintendent, and the Architect's principle construction administration representative shall be scheduled for attendance as a minimum. Sub-contractor representatives of the principle trades involved in the commissioning process should also be in attendance and may be scheduled for attendance at the discretion of the CxM.

The Commissioning Team's CxA shall present and review the status and development of the plan and shall review all requirements of the plan in detail. The review shall include the Contractor's approach to management and administration of the commissioning process, reporting lines and communications, record keeping, construction integration and coordination, commissioning procedures and sequencing, and plan format.

The Contractor's CxM shall record participant comments and distribute minutes of the meeting to all parties involved.

3.2 PRE-CONSTRUCTION COMMISSIONING REVIEW MEETING

- A. The Contractor's CxM shall schedule and chair a pre-construction commissioning review meeting to present the commissioning plan to all commissioning representatives. The meeting shall be held prior to the start of installation of any systems or equipment required to be provided with commissioning services. All commissioning representatives, associated manufacturer's representatives, outside agents involved in the commissioning process, the Contractor's field superintendent, and the Architect's principle construction administration representative shall be scheduled to attend the meeting.

Provide meeting date notification of all required participants a minimum of four weeks prior to the meeting. The meeting notification shall include a detailed agenda.

The review meeting shall address the following items as a minimum.

Meeting introduction by CxM

Introduction of participants by CxM

Commissioning requirements review by CxA

Commissioning plan introduction by CxA

Approach to procedure implementation by CxA

Commissioning management and administration review by CxM

Contractor roles and responsibilities by CxM

Special testing agents, outside agents, and manufacturer's participation by CxM

Procedure sequencing and schedule review by CxM

Comments and discussion.

Meeting minutes shall be recorded and distributed to all participants by the CxM

3.3 PRE-FUNCTIONAL CHECKLISTS

- A. The Contractor shall complete Pre-Functional Checklists as supplied by the CxA to verify systems, subsystems, and equipment installation is complete and systems are ready for Systems Functional Performance Testing. The Commissioning Agent will prepare Pre-Functional Checklists to be used to document equipment installation. The Contractor shall complete the checklists. Completed checklists shall be submitted to the VA and to the Commissioning Agent for review. The Commissioning Agent may spot check a sample of completed checklists. If the Commissioning Agent determines that the information provided on the checklist is not accurate, the Commissioning Agent will return the marked-up checklist to the Contractor for correction and resubmission. If the Commissioning Agent determines that a significant number of completed checklists for similar equipment are not accurate, the Commissioning Agent will select a broader sample of checklists for review. If the Commissioning Agent determines that a significant number of the broader sample of checklists is also inaccurate, all the checklists for the type of equipment will be returned to the Contractor for correction and resubmission. Refer to SECTION 01 91 00 GENERAL COMMISSIONING REQUIREMENTS for submittal requirements for Pre-

Functional Checklists, Equipment Startup Reports, and other commissioning documents.

3.4 CONTRACTORS TESTS

- A. Contractor tests as required by other sections of Division 23 shall be scheduled and documented in accordance with Section 01 00 00 GENERAL REQUIREMENTS. The Commissioning Agent will witness selected Contractor tests. Contractor tests shall be completed prior to scheduling Systems Functional Performance Testing.

3.5 SYSTEMS FUNCTIONAL PERFORMANCE TESTING:

- A. The Commissioning Process includes Systems Functional Performance Testing that is intended to test systems functional performance under steady state conditions, to test system reaction to changes in operating conditions, and system performance under emergency conditions. The Commissioning Agent will prepare detailed Systems Functional Performance Test procedures for review and approval by the Resident Engineer. The Contractor shall review and comment on the tests prior to approval. The Contractor shall provide the required labor, materials, and test equipment identified in the test procedure to perform the tests. The Commissioning Agent will witness and document the testing. The Contractor shall sign the test reports to verify tests were performed. See Section 01 91 00 GENERAL COMMISSIONING REQUIREMENTS, for additional details.

3.6 COMMISSIONING PROGRESS AND COORDINATION MEETINGS

The Contractor's CxM shall convene and chair regularly scheduled, on-site, commissioning review, progress, and coordination meetings. The meetings shall include the CxM, all Contractor's commissioning representatives, the OxA, the CxA or appointed representative, and associated special testing agents, outside agents, or manufacturer's representatives as appropriate.

The regular meetings shall be initiated after completion of the pre-construction commissioning review meeting and shall be held at least

3.7 PRE-PROCEDURE REVIEW MEETINGS

- A. The Contractor's CxM shall schedule and chair a procedure review meeting, held on site, immediately prior to commencing each type of procedure (functional testing), for each different system included in the commissioning process. All commissioning representatives, associated manufacturer's representatives, and outside agents required

for the commissioning procedure to be reviewed shall be scheduled to attend the meeting.

Each procedure review meeting shall include a written agenda prepared by the CxM. The agenda shall include the following items as a minimum.

Introduction of subject by Contractor's CxM

Introduction of participants by Contractor's CxM

System overview by Architect's Representatives

Construction status review by CxM

Commissioning process review by CxA

Special system or equipment component review by manufacturer's representatives.

Review of control system interface, status, and instructional discussion of related operations where pertinent.

Review of equipment installation and operations manuals by manufacturer's representatives where pertinent.

Procedure review meetings for the continuation of repetitive procedures, for similar systems and equipment previously commissioned, may be reduced in scope to include only a general review of the commissioning process and construction status.

3.8 PROCEDURE CLOSE-OUT MEETING

The Contractor's CxM shall schedule and chair a procedure close-out meeting, held on site, immediately following the completion of all functional performance testing procedures. All commissioning representatives, associated manufacturer's representatives, and outside agents required for the commissioning procedure shall be scheduled to attend the meeting.

The CxA shall review the commissioning procedures applied and general status and findings of the procedure.

The Contractor's CxM shall receive comments from the participants, and record all comments and the CxA's findings in the minutes of the meeting. The meeting minutes shall be distributed to all commissioning representatives by the CxM.

The CxM shall obtain the signatures of all representatives involved as verification of procedure attendance prior to closing the meeting. 3.9

PROCEDURE ACCEPTANCE

A. On-Site Conditional Acceptance

Upon satisfactory completion of each commissioning procedure and completion of the procedure close-out meeting, the CxA shall provide conditional acceptance of the procedure.

Conditional acceptance shall indicate that the related installation work checked by the procedure and the related performance verified by the procedure is satisfactory, and that the required procedure has been completed, only.

Conditional acceptance shall not imply that the equipment and systems involved with the procedure are fully approved and have been provided with final acceptance. Conditional acceptance shall additionally be subject to all notes and comments included in the field notes or test forms, and subject to the satisfactory demonstration that all associated pre-testing, special testing, special testing reports, or alignment reports have been fully completed.

Conditional acceptance shall be indicated by the signature of the CxA on the Architect's review and approval stamp affixed to the back side of the procedure form. Conditional acceptance shall be further limited to the numeric approval rating and corresponding definitions applied to the Architect's review stamp by the CxA, as follows.

An approval status of "1" shall indicate that conditional approval is granted as defined above.

An approval status of "2" shall indicate that conditional approval is granted subject to the conditions noted. An approval status of "2" may be granted where only minor or limited corrections are required which would not necessitate repeating the full procedure. Corrections may be completed by the Contractor and demonstrated as complete during subsequent commissioning procedures. It shall be the responsibility of the CxM to obtain an additional separate approval signature by the CxA after adequately demonstrating full compliance with the notes, comments, and conditions. The CxA may indicate subsequent additional approvals by adding a second signature, date, and numeric rating to either the original test form approval stamp or to a copy of the original.

An approval status of "3" shall indicate that the procedure has not demonstrated satisfactory installation or performance to the extent required by the procedure and in compliance with the Contract Documents. An approval status of "3" shall require the entire

procedure to be repeated after corrections or modifications are provided.

B. Procedure Final Acceptance

Procedure final acceptance shall be provided upon satisfactory submittal of the completed procedure demonstrating an on-site conditional acceptance status of "1". Acceptance may additionally be provided for submittals having a conditional field acceptance status of "2", if the submittal is accompanied by clear demonstration of full compliance with associated notes and conditions.

Procedure submittals shall be provided as hard copies of each completed commissioning procedure printed from the final computerized procedure file, complete with all test data, notes, and comments. Each submittal shall be accompanied by a copy of the original field-annotated forms and the on-site approval stamp and comments.

All procedure submittals shall be accompanied by all associated special test reports, adjusting and balancing reports, alignment reports, vibration analysis reports, completed trend logs, reports and verification items required by the procedure, completed in final form. All attached reports, logs, or data shall be separately identified.

Provide a single cover sheet, imprinted with the Architect's submittal review stamp, indicating the procedure identification, procedure date, and identifying all attached reports, logs, or data. Each procedure shall be submitted to the CxA for review and approval separately and will be reviewed in conjunction with all attached reports, logs, and data.

5. Acceptance shall be indicated by the signature of the CxA on the Architect's review and approval stamp affixed to the submittal cover sheet. Acceptance shall be limited to the numeric approval rating and corresponding definitions applied to the Architect's review stamp by the CxA, as follows.

- a. An approval status of "1" shall indicate that the related installation work checked by the procedure and the related performance verified by the procedure is in compliance with the Contract Documents, to the extent determined by the procedure, and that the required procedure has been completed and fully

documented in final form with all required data and special reports.

An approval status of "2" shall indicate that conditional approval is granted subject to the conditions noted. An approval status of "2" may be granted where only minor or limited corrections are required to the supporting attached reports or accompanying data. Corrections may be completed by the Contractor and resubmittal is not required.

An approval status of "3" shall indicate that the supporting data, reports, or the procedure are not complete, sufficient, or have not demonstrated satisfactory installation or performance to the extent required by the procedure and in compliance with the Contract Documents. An approval status of "3" shall require corrections and subsequent resubmittal and may require the entire procedure, or portions of the procedure, to be repeated as directed by the CxA.

C. On-Site Procedure Rejection

1. The CxA shall have the authority to reject a procedure in its entirety or to cause the procedure to be stopped if in the opinion of the CxA, any of the following conditions exist:

The pre-procedure review meeting is incomplete.

Appropriate or sufficient contractor staff is not available or required commissioning representatives are not present.

Required pre-testing or report data, such as point-to-point control verifications, alignment reports, and trend log data is not available or is incomplete.

The installation is insufficient or incomplete as required for the procedure or not in compliance with the Contract Documents.

Numerous checks or tests fail or can not be accomplished.

Installation and/or operation of equipment or systems beyond or in advance of the commissioning requirements. Installation, operation, or commissioning not in compliance with the sequencing requirements.

Indication of improper maintenance or operation.

Inadequate instrumentation

The procedure close-out meeting is incomplete.

2. The CxA shall additionally reject a procedure and require the equipment operation or procedure to be stopped if in the opinion of

the CxA unsafe conditions to either staff or equipment exist. Consideration of safety issues by the CxA shall not in any way relieve the Contractor from his sole responsibility for job site safety and protection of the equipment.

Direction to stop the procedure or halt the operation of equipment will be given verbally. Upon notification the Contractor shall immediately stop the procedure and restore the system or equipment to a safe condition.

At the discretion of the CxA, the Contractor may be afforded the opportunity to correct the conditions indicated by the CxA and resume the procedure.

If in the opinion of the CxA corrections cannot be implemented in a satisfactory manner, within the scheduled time available for the procedure and with sufficient time available to complete the procedure, the procedure shall be stopped and rescheduled by the CxM. The CxA shall provide the CxM with written notification of procedure rejection stating the cause of the action.

The Contractor shall be liable for all actual costs associated with the required attendance by the CxA, the Owner's and A/E's commissioning representatives, and required outside agents, resulting from rejected procedure.

Actual costs shall include:

Cost for the CxA and for each Owner's and A/E's commissioning representative, which are comprised of contractual billing rate as defined in the respective organization's agreement for such work, including overhead and profit. For CxA and A/E's commissioning representatives, these rates may be found in the A/E schedule for additional services.

Travel-related expenses for the CxA and for each Owner's or A/E's commissioning representative, where such staff is required to be in attendance and not headquartered within the city limits, which are comprised of compensation for actual travel time, with an established minimum of 5 hours, and mileage rates, billed at the prevailing national government rate.

Costs assessed for required outside agents, contractors, or specialists employed by the Owner or A/E at the actual contractual billing rates as defined in the respective organization's agreement for such work.

d. Equipment rentals, special tools, and related material fees associated with the participation of contracted outside organizations and specialists.

8. The costs assessed will be documented by the CxA and will be deducted from the Contractor's fees or progress payments at the time of occurrence.

3.10 PROCEDURE ACCEPTANCE

Changes to the work shall be as directed by Change Order, Construction Change Directive, or Order for Minor Change as defined in the General Conditions of the Contract.

The CxA shall have authority to issue Orders for Minor Change, on behalf of the Owner and the Architect, on-site, in conjunction with the commissioning activities. Such directions to the contractor will be provided in writing and will be signed and dated by the CxA.

The CxM shall have authority to accept Orders for Minor Change on behalf of the Contractor. The CxM, if in agreement with the Order for Minor Change, shall sign and date the Order and provide one copy to the CxA for record purposes.

All changes to the work shall be attached to the related procedures and shall be included as attachments to the submittals and to the final Project Commissioning Record.

If in the opinion of the CxA, Change Orders or Construction Change Directives are required, or other special provisions are necessary to resolve a commissioning, construction, or performance issue, the issue and recommendations will be documented by the CxA and submitted to the Architect's construction administration staff for disposition. If the continuation of a commissioning procedure is affected by the issue, the procedure will be continued to the extent possible or as determined appropriate by the CxA. The CxA shall have full authority to stop or postpone any procedure pending disposition of commissioning, construction, or performance issues.

3.11 PROCEDURE ACCEPTANCE

Final acceptance will be contingent upon satisfactory completion of all commissioning tasks and submittals, with final review and approval by the Commissioning Authority.

Where specific components, equipment, or system elements are unable to comply with the specified requirements due to improper or incomplete installation, product defect, or failure of a device to perform to the

manufacturer's published or advertised capabilities, final acceptance will be contingent on repair, replacement, and correction of the deficiencies by the Contractor and satisfactory completion of the commissioning procedures.

Where specific components, equipment, or system elements are demonstrated to comply with the specified requirements and perform to the manufacturer's published or advertised capabilities, but are demonstrated not to provide the performance as required by the Contract Documents and the commissioning procedures, disposition of the issue and/or related modifications shall be provided as directed by the Architect. Final acceptance shall be contingent on the completion of any resulting correction work and related commissioning requirements determined as necessary in final disposition of the issue.

Upon satisfactory completion of all commissioning work and resolution of all related issues, the CxA shall provide the Owner, Contractor, and the Architect with a final report documenting recommendation for final acceptance. Recommendation for final acceptance by the CxA shall indicate that in the opinion of the CxA, and as demonstrated within the extent and scope of the commissioning process, the equipment and systems have been installed in compliance with, and function as required by the Contract Documents.

The Owner may accept the recommendation of the CxA and provide final acceptance by providing the appropriate authorized signature and by providing copies of the signed acceptance to all parties involved. The Owner's final acceptance of the commissioning work shall indicate that Owner accepts that the systems and equipment, as demonstrated within the extent and scope of the commissioning process, have been installed in compliance with, and function as required by, the Contract Documents. The Owner's acceptance shall not constitute agreement that all contractual obligations are fulfilled and does not constitute final acceptance of the project under the terms and conditions of the Contract Documents.

3.12 TRAINING OF VA PERSONNEL

- A. Training of the VA's operation and maintenance personnel is required in cooperation with the Resident Engineer and Commissioning Agent. Provide competent, factory authorized personnel to provide instruction to operation and maintenance personnel concerning the location, operation, and troubleshooting of the installed systems. The

instruction shall be scheduled in coordination with the Resident Engineer after submission and approval of formal training plans. Refer to Section 01 91 00 GENERAL COMMISSIONING REQUIREMENTS and Division 23 Sections for additional Contractor training requirements.

--- END ---

SECTION 23 09 23
CONTROLS AND INSTRUMENTATION (DDC)

PART 1 - GENERAL

1.1 WORK INCLUDED

Furnish a totally native Alerton BACnet-based system. System shall be connected to existing operator's workstations in building 114, 50, & 46 (2 each) using Microsoft Windows 2000 Professional or XP Professional as the operating system and shall be based on a distributed control system in accordance with this specification. The operator's workstation, all building controllers, application controllers, and all input/output devices shall communicate using the protocols and network standards as defined by ANSI/ASHRAE Standard 135-2001, BACnet. In other words, all workstations and controllers, including unitary controllers, shall be native BACnet devices. No gateways shall be used for communication to controllers installed under this section. Gateways may be used for communication to existing systems or to systems installed under other sections. Prepare individual hardware layouts, interconnection drawings, and software configuration from project design data as needed. Implement the detailed design for all analog and binary objects, system databases, graphic displays, logs, and management reports based on control descriptions, logic drawings, configuration data, and bid documents.

Design: Provide, and install all equipment cabinets, panels, data communication network cables needed, and all associated hardware. Provide and install all interconnecting cables between supplied cabinets, application controllers, and input/output devices. Provide and install all interconnecting cables between all operator's terminals and peripheral devices (such as printers, etc.) supplied under this section.

Provide supervisory specialists and technicians at the job site to assist in all phases of system installation, startup, and commissioning.

Provide a comprehensive operator and technician training program. Provide as-built documentation on approved media, the sum total of which accurately represents the final system.

Provide new sensors, dampers, and valves where required. Install only new electronic actuators. No used components shall be used as any part or piece of installed system.

Demolish all equipment and material as required to complete work specified. Remove from VA property and properly dispose of all resulting waste materials.

1.2 RELATED WORK

Section 230511, BASIC METHODS AND REQUIREMENTS (MECHANICAL)

Section 232113 & 232213, HVAC PIPING SYSTEMS

Section 230593, TESTING, ADJUSTING AND BALANCING

Section 270533, CONDUIT SYSTEMS

Section 260521, CABLES, LOW VOLTAGE

1.3 SUBMITTALS

A. Detailed sequence of operation

1.4 WARRANTY

Warranty shall cover all costs for parts, labor, associated travel, and expenses for a period of one year from completion of system acceptance.

Hardware and software personnel supporting this warranty agreement shall provide on-site or off-site service in a timely manner after failure notification to the vendor. The maximum acceptable response time to provide this service at the site shall be 24 hours Monday through Friday, 48 hours on Saturday and Sunday.

B. This warranty shall apply equally to both hardware and

software. PART 2 - PRODUCTS

2.0 BUILDING CONTROLLER (GLOBAL CONTROLLER - BCM POWER SUPPLY AND BCM ETHERNET MODULE IF NO GLOBAL CONTROLLER EXISTS, BCM MS/TP IF EXPANSION OF EXISTING BCM IS REQUIRED)

A. General

1. All communication with operator workstation and all application controllers shall be via BACnet. Building controller shall incorporate as a minimum, the functions of a 3-way BACnet router. Controller shall route BACnet messages between the high-speed LAN (Ethernet 10/100MHz), master slave token passing (MS/TP) LANs, a point-to-point (PTP - RS-232) connection and modem.

a. Each MS/TP LAN must be software configurable from 9.6 to 76.8Kbps.

The RJ-45 Ethernet connections must accept either 10Base-T or 100Base-TX BACnet over twisted pair cable (UTP).

The direct access port must be a female DB-9 connector supporting BACnet temporary PTP connection of a portable BACnet operator terminal at 9.6 to 115.2 Kbps over RS-232 null modem cable.

Building controller shall be capable of providing global control strategies for the system based on information from any objects in the system regardless if the object is directly monitored by the controller or by another controller. The program that implements these strategies shall be completely flexible and user definable. Any systems utilizing factory pre-programmed global strategies that cannot be modified by field personnel on-site or downloaded via remote communications are not acceptable. Changing global strategies via firmware changes is also unacceptable.

Programming shall be object-oriented using control function blocks, supporting DDC functions, 1000 Analog Values and 1000 Binary Values. All flowcharts shall be generated and automatically downloaded to controller. Programming tool shall be resident on workstation and the same tool used for all controllers.

Provide means to graphically view inputs and outputs to each program block in real-time as program is executing. This function may be performed via the operator's workstation or field computer.

Building controller shall provide battery-backed real-time (hardware) clock functions.

Controller shall have a memory needed to ensure high performance and data reliability. Battery shall retain static RAM memory and real-time clock functions for a minimum of 1.5 years (cumulative).

Global control algorithms and automated control functions should execute via 32-bit processor.

Controller installation shall include memory-free gel-cell battery providing ongoing power conditioning and noise filtering for operation data integrity. It shall provide up to 5 minutes of powerless operation for orderly shutdown and data backup.

9. Install an outdoor air temperature sensor for each new global controller installed.

2.1 CENTRAL PLANT APPLICATION CONTROLLERS

Provide one or more native BACnet application controllers for the chillers and pumps and provide native BACnet application controllers as needed for central plant control that adequately cover all objects listed in object list. All controllers shall interface to building controller via MS/TP LAN using BACnet protocol. No gateways shall be used. Controllers shall include input, output and self-contained logic program as needed for complete control of units. Controllers shall be fully programmable using graphical programming blocks. Programming tool shall be resident on operator workstation and be the same tool as used for the building controller. No auxiliary or non-BACnet controllers shall be used.

BACnet Conformance

1. Application controllers shall as a minimum support MS/TP BACnet LAN types. They shall communicate directly via this BACnet LAN at 9.6, 19.2, 38.4 and 76.8 Kbps, as native BACnet devices. Application controllers shall be of BACnet conformance class 3 and support all BACnet services necessary to provide the following BACnet functional groups:
 - Files Functional Group
 - Reinitialize Functional Group
 - Device Communications Functional Group
2. Please refer to section 22.2, BACnet Functional Groups, in the BACnet standard, for a complete list of the services that must be directly supported to provide each of the functional groups listed above. All proprietary services, if used in the system, shall be thoroughly documented and provided as part of the submittal data. All necessary tools shall be supplied for working with proprietary information.
3. Standard BACnet object types supported shall include as a minimum—Analog Input, Analog Output, Analog Value, Binary Input, Binary Output, Binary Value, Device, File, and Program object types. All proprietary object types, if used in the system, shall be thoroughly documented and provided as part of the submittal data. All necessary tools shall be supplied for working with proprietary information.

Application controllers shall include universal inputs with 10-bit resolution that accept 3K and 10K thermistors, 0-10VDC, 0-5 VDC, 4-20 mA and dry contact signals. Any input on a controller may be either analog or digital with a minimum of 3 inputs that accept pulses. Controller shall also include support and modifiable programming for interface to intelligent room sensor with digital display. Controller shall include binary and analog outputs on board. Analog outputs shall be switch selectable as either 0-10VDC or 0-20mA. Software shall include scaling features for analog outputs. Application controller shall include 24VDC voltage supply for use as power supply to external sensors.

All program sequences shall be stored on board application controller in EEPROM. No batteries shall be needed to retain logic program. All program sequences shall be executed by controller 10 times per second and capable of multiple PID loops for control of multiple devices. All calculations shall be completed using floating-point math and system shall support display of all information in floating-point nomenclature at operator's terminal. Programming of application controller shall be completely modifiable in the field over installed BACnet LANs or remotely via modem interface. Operator shall program logic sequences by graphically moving function blocks on screen and tying blocks together on screen. Application controller shall be programmed using programming tools as described in operator's terminal section.

Application controller shall include support for intelligent room sensor (see section 2.9.B.) Display on intelligent room sensor shall be programmable at application controller and include an operating mode and a field service mode. All button functions and display data shall be programmable to show specific controller data in each mode based on which button is pressed on the sensor. See sequence of operation for specific display requirements at intelligent room sensor.

2.2 SENSORS AND MISCELLANEOUS DEVICES

A. Temperature Sensors

1. All temperature sensors to be solid state electronic, factory-calibrated to within 0.5°F, totally interchangeable with housing appropriate for application. Mount wall sensors over location of existing thermostats, or if not replacing an existing thermostat,

mount 48 inches about finished floor. Duct sensors to be installed such that the sensing element is in the main air stream. Immersion sensors to be installed in wells provided by control contractor. Immersion wells shall be filled with thermal compound before installation of immersion sensors. Outside air sensors shall be installed away from exhaust or relief vents, not in an outside air intake and in a location that is in the shade most of the day.

B. Intelligent Room Sensor with LCD Readout

Sensor shall contain a backlit LCD digital display and user function keys along with temperature sensor. Controller shall function as room control unit, and shall allow occupant to raise and lower setpoint, and activate terminal unit for override use—all within limits as programmed by building operator. Sensor shall also allow service technician access to hidden functions as described in sequence of operation.

The Intelligent Room Sensor shall simultaneously display room setpoint, room temperature, outside temperature, and fan status (if applicable) at each controller. This unit shall be programmable, allowing site developers the flexibility to configure the display to match their application. The site developer should be able to program the unit to display time-of-day, room humidity and outdoor humidity. Unit must have the capability to show temperatures in Fahrenheit or Centigrade.

Override time may be set and viewed in half-hour increments. Override time count down shall be automatic, but may be reset to zero by occupant from the sensor. Time remaining shall be displayed. Display shall show the word "OFF" in unoccupied mode unless a function button is pressed.

See sequence of operation for specific operation of LCD displays and function keys in field service mode and in normal occupant mode. Provide intelligent room sensors as specified in point list.

Field service mode shall be customizable to fit different applications. If intelligent room sensor is connected to VAV controller, VAV box shall be balanced and all airflow parameters shall be viewed and set from the intelligent room sensor with no computer or other field service tool needed.

C. Wall Sensor

1. Standard wall sensor shall use solid-state sensor identical to intelligent room sensor and shall be packaged in aesthetically pleasing enclosure. Sensor shall provide override function, warmer/cooler lever for set point adjustment and port for plug-in of Field Service Tool for field adjustments. Override time shall be stored in controller and be adjustable on a zone-by-zone basis. Adjustment range for warmer/cooler lever shall also be stored in EEPROM on controller. All programmable variables shall be available to Field Service Tool through wall sensor port.

2.3 ELECTRONIC ACTUATORS AND VALVES

A. Quality Assurance for Actuators and Valves

UL Listed Standard 873 and C.S.A. Class 4813 02 certified.

NEMA 2 rated enclosures for inside mounting, provide with weather shield for outside mounting.

B. Execution Details for Actuators and Valves

Furnish a Freeze-stat and install "Hard Wire" or DDC freeze stat (coordinate with owner). Interlock to disconnect the mechanical spring return actuator power circuit for fail-safe (heat mode) operation. Use of the control signal to drive the actuators closed is not acceptable except when using DDC freeze stat.

VAV box damper actuation shall be Floating type or Analog (2-10vdc, 4-20ma).

Booster-heat valve actuation shall be Floating type or Analog (2-10vdc, 4-20ma).

Primary valve control shall be Analog (2-10vdc, 4-20ma).

C. Actuators for Damper and Control Valves 1/2" to 6" shall be Electric unless otherwise specified, provide actuators as follows:

UL Listed Standard 873 and Canadian Standards association Class 481302 shall certify Actuators.

NEMA 2 rated actuator enclosures are. Use additional weather shield to protect actuator when mounted outside.

Mechanical spring shall be provided when specified. Capacitors or other non-mechanical forms of fail-safe are not acceptable.

Position indicator device shall be installed and made visible to the exposed side of the Actuator. For damper short shaft mounting, a separate indicator shall be provided to the exposed side of the Actuator.

Overload Protection: Actuators shall provide protection against actuator burnout by using an internal current limiting circuit or digital motor rotation sensing circuit. Circuit shall insure that actuators cannot burn out due to stalled damper or mechanical and electrical paralleling. End switches to deactivate the actuator at the end of rotation are acceptable only for Butterfly Valve actuators.

A push button gearbox release shall be provided for all non-spring actuators.

Modulating actuators shall be 24Vac and consume 10VA power or less.

Conduit connectors are required when specified and when code requires it.

D. Valve Actuators 1/2" to 6"

Mechanical spring shall be provided on all actuators for pre-heat coil and actuators for AHU heating or cooling coil when units are mounted outside. See plans for fail save flow function: Normal Open or Normal Closed. Capacitors or other non-mechanical forms of fail-safe are not acceptable.

All zone service actuators shall be non-spring return unless otherwise specified.

The valve actuator shall be capable of providing the minimum torque required for proper valve close off for the required application.

All control valves actuators shall have an attached 3-foot cable for easy installation to a junction box.

Override handle and gearbox release shall be provided for all non-spring return valve actuators.

4. Valve Sizing for Water Coil

On/Off Control Valves shall be line size.

Modulating Control Valve Body Size may be reduced at most two-pipe sizes from the line size or not less than 1/2 the pipe size. The BAS contractor shall size all water coil control valves for the application as follows:

- i. Booster-heat valves shall be sized not to exceed 4-9psi differential pressure. Size valve for 50% Valve Authority. Valve design pressure drop is equal to the sum of coil drop plus the balance valve drop.

Primary valves shall be sized not to exceed 5-15psi differential pressure. Size valve for 50% Valve Authority. Valve design pressure drop is equal to the sum of coil drop plus the balance valve drop.

Butterfly valves shall be sized for modulating service at 60-70 degree rotation. Design velocity shall be 12 feet per second or less when used with standard EPDM seats. c. Valve mounting arrangements shall comply to the following:

Unions shall be provided on all ports of two-way and three-way valves.

Install three-way equal percentage Characterized Control valves in a mixing configuration with the "A" port piped to the coil.

Install 2 1/2 inch and above, Three-Way globe valves, as manufactured for mixing or diverting service to the coil.

Two-Way valve shall be piped in the return side of the coil in order to minimize ambient heat at the

2.4 ENCLOSURES

All controllers, power supplies and relays shall be mounted in enclosures.

Enclosures may be NEMA 1 when located in a clean, dry, indoor environment. Indoor enclosures shall be NEMA 12 when installed in other than a clean environment.

Enclosures shall have hinged, locking doors.

Provide laminated plastic nameplates for all enclosures in any mechanical room or electrical room. Include location and unit served on nameplate. Laminated plastic shall be 1/8" thick sized appropriately to make label easy to read.

2.5 WIRING

A. All communication wiring shall be labeled Altelton communication cable. **PART 3 - EXECUTION**

3.1 EXAMINATION

Prior to starting work, carefully inspect installed work of other trades and verify that such work is complete to the point where work of this Section may properly commence.

Notify the owners' representative in writing of conditions detrimental to the proper and timely completion of the work.

Do not begin work until all unsatisfactory conditions are resolved.

3.2 INSTALLATION (GENERAL)

Install in accordance with manufacturer's instructions.

Provide all miscellaneous devices, hardware, software, interconnections installation and programming required to ensure a complete operating system in accordance with the sequences of operation and point schedules.

Installation control components shall be the full responsibility of, and provided by, the control contractor. The control contractor may subcontract out the installation to qualified electricians.

Provide and install all control conduits required. See Division 16.

3.3 LOCATION AND INSTALLATION OF COMPONENTS

Locate and install components for easy accessibility; in general, mount 48 inches above floor with minimum 3'-0" clear access space in front of units. Obtain approval on locations from owner's representative prior to installation.

All instruments, switches, transmitters, etc., shall be suitably wired and mounted to protect them from vibration, moisture and high or low temperatures.

Identify all equipment and panels. Provide permanently mounted tags for all panels.

Provide stainless steel or brass thermowells suitable for respective application and for installation under other sections—sized to suit pipe diameter without restricting flow.

3.4 INTERLOCKING AND CONTROL WIRING

Provide all interlock and control wiring. All wiring shall be installed neatly and professionally, in accordance with all national, state and local electrical codes.

Provide wiring as required by functions as specified and as recommended by equipment manufacturers, to serve specified control functions. Provide shielded low capacitance wire for all communications trunks.

Control wiring shall not be installed in power circuit raceways.

Magnetic starters and disconnect switches shall not be used as junction boxes. Provide auxiliary junction boxes as required.

Coordinate location and arrangement of all control equipment with the owner's representative prior to rough-in.

Provide auxiliary pilot duty relays on motor starters as required for control function.

Provide power for all control components.

All control wiring in the mechanical, electrical, telephone, boiler rooms, and spaces without suspended ceilings is to be installed in raceways, except where approved otherwise by the VA. Control wiring above accessible ceiling spaces may be run with plenum rated cable (without conduit).

Use existing underground raceways to run wiring between buildings as required. Coordinate exact routing of wiring with VA prior to installation.

3.5 DDC OBJECT TYPE SUMMARY

Provide all database generation.

Displays

1. System displays shall show all analog and binary object types within the system. They shall be logically laid out for easy use by the owner. Provide outside air temperature indication on all system displays.

Run Time Totalization

1. At a minimum, run time totalization shall be incorporated for each monitored supply fan, return fan, exhaust fan, hot water and chilled water pumps. Warning limits for each point shall be entered for alarm and or maintenance purposes.

Trendlog

1. All binary and analog object types (including zones) shall have the capability to be automatically trended.

Alarm

1. All analog inputs (High/Low Limits) and selected binary input alarm points shall be prioritized and routed (locally or remotely) with alarm message per owner's requirements. Create or update existing building overall alarm screen.

Database Save

1. Provide back-up database for all stand-alone application controllers on disk.

3.6 FIELD SERVICES

Prepare and start logic control system under provisions of this section.

Start-up and commission systems. Allow sufficient time for start-up and commissioning prior to placing control systems in permanent operation.

Provide the capability for off-site monitoring at control contractor's local or main office. At a minimum, off-site facility shall be capable of system diagnostics and software download.

Provide Owner's Representative with spare parts list. Identify equipment critical to maintaining the integrity of the operating system. 3.7

TRAINING

Provide application engineer to instruct owner in operation of systems and equipment.

Provide system operator's training to include (but not limited to) such items as the following: modification of data displays, alarm and status descriptors, requesting data, execution of commands, and request of logs. Provide this training to a minimum of 3 persons.

Provide on-site training above as required.

3.8 DEMONSTRATION

Provide systems demonstration.

Demonstrate complete operating system to owner's representative.

Provide certificate stating that control system has been tested and adjusted for proper operation.

PART 4 - SUMMARY

4.1 GENERAL

HVAC control system shall consist of microprocessors, sensors, indicators, switches, and final control elements, low voltage plenum wiring and termination to Controlled Equipment. Interface software and equipment for the existing front end P/C based system. Graphical based control screens, and other accessories, which will provide a complete HVAC control system package for the heating and cooling equipment.

Provide and install the software system to enable the end user at the facility to manage a wide range of parameters for each piece of controlled mechanical equipment located throughout the building using the existing computer terminals in buildings 114, 50, and 46.

Facility management shall be able to install or update day-to-day schedules as well as event, holiday, and after hour's schedules. Program each piece of equipment into an established schedule or create new schedules for a group of equipment as requested by the VA.

The computer environment shall be a windows based program with security levels and will be password protected for each user(s). Custom programming of the system will enable the end user(s) to navigate through different levels of informational GUI (graphical user interface) screens with computer graphics and floor plans indicating the status of each piece of mechanical equipment controlled. Graphics shall match the existing scheme of architecture in use at the VA. Contractor is to receive approval of graphics from VA prior to install.

Create/update com wire riser diagram on operators' screens.

F. End user(s) shall also be able to trend log occupants setpoints, room temperature, supply air temperatures and alarms in order to generate management reports.

Programming of DDC controllers to accomplish specified sequence of operation for each piece of mechanical equipment controlled. Coordinate with owner. Naming/tagging of equipment is to be approved by VA prior to final programming. All device identifications shall include the building number where the device is located. All DDC files must be located in existing subfolders in accordance with existing layout. Program alarms as requested by the VA.

Provide technical support for the facility management to help trouble-shoot possible mechanical problems through the use of the P/C software.

Provide one year warranty.

Provide training for the operation of the control system.

At the conclusion of the work, provide a detailed written sequence of operation in digital, "Microsoft Word", format. Sample sequence of operations are available from the VA upon request.

PART 5 - SEQUENCE OF OPERATIONS

5.1 GENERAL

A. Provide a complete and operational temperature control and building automation system based on the following points and sequence of operation. The system shall be complete as to sequences and standard control practices. The determined point list is the minimum amount of points that are to be provided. If additional points are required to meet the sequence of operation, they will be provided.

B. BACnet Object List

1. The following points as defined for each piece of equipment are designated as follows:

Binary Out (BO) - Defined as any two-state output (start/stop) (enable/disable), etc.

Binary In (BI) - Defined as any two-state input (alarm, status), etc.

Analog In (AI) - Defined as any variable input (temperature) (position), etc.

Analog Out (AO) - Defined as any electrical variable output. 0-20mA, 4-20mA and 0-10VDC are the only acceptable analog outputs. The driver for analog outputs must come from both hardware and software resident in the controllers.

Transducers will not be acceptable under any circumstance.

5.2 SEQUENCE OF OPERATION: verify with owner and receive approval prior to programming.

See separate equipment list of what will be controlled under this contract titled "Equipment to be Included in DDC System". See attached sheet titled "Equipment Items to Control and Monitor" for a listing of the points to control and/or monitor for each type of equipment. Although these are detailed lists, any other devices, controllers, or equipment needed to meet the owner's sequence of operation shall be of no charge to the owner. Any change orders shall be coordinated with the owner.

Building 27: Provide and install a BCM/MSTP communications global controller. Locate inside existing global controller panel. Global controller will provide all schedules, alarms, and trend logs. Provide all programming required for interconnecting to the existing system.

Provide alarms, trend logs, as needed for all points.

Communication shall be from existing campus network in communication closet. Connect and verify all controllers are operational.

5.3 PRIMARY LOOP HEATING PUMPS

A. Primary Loop Heating Pump Run Conditions:

1. The primary loop heating pumps shall be enabled whenever:

Heating Water Primary Loop Temperature Drops Below 120° F (adj.)

AND the outside air temperature is less than 54° F (adj.).

B. Primary Loop Heating Pump Lead/Lag Operation:

1. The two variable speed hot water pumps shall operate in a lead/lag fashion:

The lead pump shall run first.

On failure of the lead pump, the lag pump shall run and the lead pump shall turn off and initiate alarm.

2. The designated lead pump shall rotate upon one of the following conditions (user selectable):

Manually through a software switch.

If pump runtime (adj.) is exceeded.

3. Alarms shall be provided as follows:

P-HWHS-1, 3

- i. Failure: Commanded on, but the status is off.

P-HWHS-2, 4

- i. Failure: Commanded on, but the status is off.

C. Heating Water Temperature Monitoring:

1. The following temperatures shall be monitored:

Heating loop supply.

Heating loop return.

2. Alarms shall be provided as follows:

High Heating Water Supply Temp: If the heating water supply temperature is greater than 200°F (adj.).

Low Heating Water Supply Temp: If the heating water supply temperature is less than 100°F (adj.) and primary loop heating water pumps are enabled.

5.4 PRIMARY CHILLED WATER LOOP PUMPS (Installed in Chiller CH-1)

A. Primary Chilled Water Loop Pump Run Conditions:

The primary chilled water loop pumps shall run whenever:

- a. The Chiller CH-1 is running.

To prevent short cycling, the pumps shall run for a minimum time and be off for a minimum time (both user adjustable).

B. Primary Chilled Water Loop Lead/Lag Operation:

1. The two variable speed chilled water pumps shall operate in a lead/lag fashion:

The lead pump shall run first.

On failure of the lead pump, the lag pump shall run and the lead pump shall turn off and initiate alarm.

2. The designated lead pump shall rotate upon one of the following conditions (user selectable):

Manually through a software switch.

If pump runtime (adj.) is exceeded.

3. Alarms shall be provided as follows:

P-CH-1

- i. Failure: Commanded on, but the status is off.

P-CH-2

- i. Failure: Commanded on, but the status is off.

C. Chilled Water Temperature Monitoring:

1. The following temperatures shall be monitored:

CH-1 Supply temperature.

CH-1 Discharge temperature.

2. Alarms shall be provided as follows:

High Chilled Water Supply Temp: If the chilled water supply temperature is greater than 55°F (adj.) and chilled water pumps are enabled.

Low Chilled Water Supply Temp: If the chilled water supply temperature is less than 40°F (adj.), and chilled water pumps are enabled.

5.5 ENERGY RECOVERY UNIT - ERU-A1 and ERU-B1

Run Conditions - Requested:

1. The unit shall run continuously whenever:
 - a. Any zone is occupied.

High Static Shutdown:

1. The unit shall shut down and generate an alarm upon receiving a high static shutdown signal.

Supply Air Smoke Detection:

1. The unit shall shut down and generate an alarm upon receiving a supply air smoke detector status.

Supply/Exhaust Fans:

The supply fan shall run anytime the unit is commanded to run, unless shutdown on safeties.

The exhaust fan shall run anytime the unit is commanded to run, unless shutdown on safeties.

3. Alarms shall be provided as follows:

Supply or Exhaust Fan Failure: Commanded on, but the status is off.

Supply or Exhaust Fan Fault.

E. Supply Air Temperature Setpoint - Outside Air Reset:

The controller shall monitor the supply air temperature and shall reset based on polling of fan coils.

The supply air temperature setpoint shall reset for economizer as follows:

If the outside air temperature is in a range from 60°F to 75°F (adj.) the outside air bypass damper shall open and allow unconditioned outside air through the ERU.

If the outside air temperature is outside the range listed above the outside air bypass damper shall close and the air shall be directed through the heat exchanger.

F. Defrost

1. The outside air face and bypass dampers shall modulate, bypassing air around the heat exchanger, to maintain the exhaust air temperature above the defrost setpoint (25°F). 5.6 FAN

COIL TERMINAL UNIT WITH HEATING AND COOLING COIL

A. Run Conditions - Requested:

1. The unit shall run according to a user definable time schedule in the following modes:

a. Occupied Mode: The unit shall maintain

A 74°F (adj.) cooling setpoint.

A 72°F (adj.) heating setpoint.

b. Unoccupied Mode (unused space): The unit shall maintain

A 80°F (adj.) cooling setpoint.

A 70°F (adj.) heating setpoint.

2. Alarms shall be provided as follows:

High Zone Temp: If the zone temperature is greater than the cooling setpoint by a user definable amount (adj.).

Low Zone Temp: If the zone temperature is less than the heating setpoint by a user definable amount (adj.).

B. Zone Setpoint Adjust:

1. The occupant shall be able to adjust the zone temperature heating and cooling setpoints at the zone sensor.

Zone Unoccupied Override:

1. A timed local override control shall allow an occupant to override the schedule and place the unit into an occupied mode for an adjustable period of time. At the expiration of this time, control of the unit shall automatically return to the schedule.

Heating Coil Valve:

1. When zone temperature is less than its heating setpoint, the controller shall measure the zone temperature and modulate the heating coil valve open on dropping temperature to maintain its heating setpoint.

Cooling Coil Valve:

1. When zone temperature is greater than its cooling setpoint, the controller shall measure the zone temperature and modulate the cooling valve open on rising temperature to maintain its cooling setpoint.

5.7 CHILLER

- A. Chiller shall be furnished with BAC/NET/IP card connected to the DDC system. The DDC system shall be capable of monitoring chiller status and alarms.
- B. Chiller Enable Conditions
Outside air temperature rises above 65°F (adj.).
And chiller pumps are enabled.
- C. Chiller pumps shall continue to run until chiller is completely cycled off.

5.8 DOMESTIC WATER HEATING SYSTEM

- A. Domestic Water Heating Pump Run Control:
 1. The domestic water heating pump shall be enabled whenever:
Building is occupied
And heating water loop control valve is open.
 2. The domestic water heating pump shall run whenever:
 - a. Storage tank temperature is below 140°F (adj.).
- B. Primary Loop Heating Pump Lead/Lag Operation:
 1. The two constant speed domestic water heating pumps shall operate in a lead/lag fashion:
The lead pump shall run first.
On failure of the lead pump, the lag pump shall run and the lead pump shall turn off.

2. The designated lead pump shall rotate upon one of the following conditions (user selectable):

Manually through software switch.

If pump runtime (adj.) is exceeded.

3. Alarms shall be provided as follows:

P-WH-1

- i. Failure: Commanded on, but the status is off.

P-HW-2

- i. Failure: Commanded on, but the status is

off. C. Hot Water Temperature Monitoring:

1. The following temperatures shall be monitored:

Primary heating loop supply to HX-1.

Primary heating loop return from HX-1.

HX-1 secondary loop leaving water temperature

HX-1 secondary loop inlet temperature

Storage tank temperature

2. Alarms shall be provided as follows:

High hot water supply temp: If the domestic water supply temperature is greater than 180°F (adj.)

Low hot water supply temp: If the domestic water supply temperature is less than 120°F (adj.) and primary loop heating water pumps are enabled.

PART 6 - APPROVED CONTRACTORS

6.1 GENERAL

- A. Control contractors who have worked on and are familiar with the DDC system in use at the Boise VA include:

ATS Inland NW

(208)891-9111

EMI Building Automation Systems

(208)321-1051

- - - E N D - - -

THIS PAGE INTENTIONALLY LEFT BLANK

SECTION 23 21 13 HYDRONIC
PIPING

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Water piping to connect HVAC equipment, including the following:
- Chilled water, heating hot water and drain piping.
 - Extension of domestic water make-up piping.
 - Glycol-water piping.

1.2 RELATED WORK

- Section 01 00 00, GENERAL REQUIREMENTS.
- Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, and SAMPLES.
- Section 31 20 00, EARTH MOVING: Excavation and backfill.
- Section 03 30 00, CAST-IN-PLACE CONCRETE.
- Section 07 12 00, BUILT-UP BITUMINOUS WATERPROOFING, and Section 07 13 52, MODIFIED BITUMINOUS SHEET WATERPROOFING.
- Section 33 10 00, WATER UTILITIES: Underground piping.
- Section 13 05 41, SEISMIC RESTRAINT REQUIREMENTS FOR NON-STRUCTURAL COMPONENTS: Seismic restraints for piping.
- Section 23 05 11, COMMON WORK RESULTS FOR HVAC: General mechanical requirements and items, which are common to more than one section of Division 23.
- Section 23 21 23, HYDRONIC PUMPS: Pumps.
- Section 23 07 11, HVAC, PLUMBING, and BOILER PLANT INSULATION: Piping insulation.
- Section 23 25 00, HVAC WATER TREATMENT: Water treatment for open and closed systems.
- Section 23 82 00, CONVECTION HEATING AND COOLING UNITS: VAV and CV units, fan coil units, and radiant ceiling panels.
- Section 23 09 23, DIRECT-DIGITAL CONTROL SYSTEM FOR HVAC: Temperature and pressure sensors and valve operators.

1.3 QUALITY ASSURANCE

- Section 23 05 11, COMMON WORK RESULTS FOR HVAC, which includes welding qualifications.
- Submit prior to welding of steel piping a certificate of Welder's certification. The certificate shall be current and not more than one year old.
- For mechanical pressed sealed fittings, only tools of fitting manufacturer shall be used.

Mechanical pressed fittings shall be installed by factory trained workers.

All grooved joint couplings, fittings, valves, and specialties shall be the products of a single manufacturer. Grooving tools shall be the same manufacturer as the grooved components.

1. All castings used for coupling housings, fittings, valve bodies, etc., shall be date stamped for quality assurance and traceability. 1.4

SUBMITTALS

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, and SAMPLES.
- B. Manufacturer's Literature and Data:
 - Pipe and equipment supports.
 - Pipe and tubing, with specification, class or type, and schedule.
 - Pipe fittings, including miscellaneous adapters and special fittings.
 - Flanges, gaskets and bolting.
 - Grooved joint couplings and fittings.
 - Valves of all types.
 - Strainers.
 - Flexible connectors for water service.
 - Pipe alignment guides.
 - Expansion joints.
 - Expansion compensators.
 - All specified hydronic system components.
 - Water flow measuring devices.
 - Gages.
 - Thermometers and test wells.
 - Electric heat tracing systems.
 - Seismic bracing details for piping.
- C. Manufacturer's certified data report, Form No. U-1, for ASME pressure vessels:
 - Heat Exchangers (Water to Water)
 - Air separators.
 - Expansion tanks.
- D. Submit the welder's qualifications in the form of a current (less than one year old) and formal certificate.
- E. Coordination Drawings: Refer to Article, SUBMITTALS of Section 23 05 11, COMMON WORK RESULTS FOR HVAC.

F. As-Built Piping Diagrams: Provide drawing as follows for chilled water, and heating hot water system and other piping systems and equipment.

One wall-mounted stick file with complete set of prints. Mount stick file in the chiller plant or control room along with control diagram stick file.

One complete set of reproducible drawings.

One complete set of drawings in electronic Autocad and pdf format.

1.5 APPLICABLE PUBLICATIONS

The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only. American National Standards Institute, Inc.

American Society of Mechanical Engineers/American National Standards Institute, Inc. (ASME/ANSI):

B1.20.1-83(R2006)Pipe Threads, General Purpose (Inch)

B16.4-06Gray Iron Threaded FittingsB16.18-01 Cast
Copper Alloy Solder joint Pressure fittings

B16.23-02 Cast Copper Alloy Solder joint Drainage
fittings

B40.100-05Pressure Gauges and Gauge Attachments

American National Standards Institute, Inc./Fluid Controls Institute
(ANSI/FCI):

70-2-2006Control Valve Seat Leakage

American Society of Mechanical Engineers (ASME):

B16.1-98Cast Iron Pipe Flanges and Flanged Fittings

B16.3-2006Malleable Iron Threaded Fittings: Class 150 and
300

B16.4-2006 Gray Iron Threaded Fittings: (Class 125 and
250)

B16.5-2003 Pipe Flanges and Flanged Fittings: NPS 1/2
through NPS 24 Metric/Inch Standard

B16.9-07 Factory Made Wrought Butt Welding Fittings

B16.11-05 Forged Fittings, Socket Welding and Threaded

B16.18-01Cast Copper Alloy Solder Joint Pressure
Fittings

B16.22-01 Wrought Copper and Bronze Solder Joint Pressure
Fittings.

B16.24-06 Cast Copper Alloy Pipe Flanges and Flanged
Fittings

- B16.39-06 Malleable Iron Threaded Pipe Unions
- B16.42-06 Ductile Iron Pipe Flanges and Flanged Fittings
- B31.1-08 Power Piping
- E. American Society for Testing and Materials (ASTM):
- A47/A47M-99 (2004) Ferritic Malleable Iron Castings
- A53/A53M-07 Standard Specification for Pipe, Steel, Black
and Hot-Dipped, Zinc-Coated, Welded
and Seamless
- A106/A106M-08 Standard Specification for Seamless Carbon
Steel Pipe for High-Temperature Service
- A126-04 Standard Specification for Gray Iron Castings
for Valves, Flanges, and Pipe Fittings
- A183-03 Standard Specification for Carbon Steel Track
Bolts and Nuts
- A216/A216M-08 Standard Specification for Steel Castings,
Carbon, Suitable for Fusion Welding, for
High Temperature Service
- A234/A234M-07 Piping Fittings of Wrought Carbon Steel and
Alloy Steel for Moderate and High
Temperature Service
- A307-07 Standard Specification for Carbon Steel Bolts
and Studs, 60,000 PSI Tensile Strength
- A536-84 (2004) Standard Specification for Ductile Iron Castings
- A615/A615M-08 Deformed and Plain Carbon Steel Bars for
Concrete Reinforcement
- A653/A 653M-08 Steel Sheet, Zinc-Coated (Galvanized) or Zinc-
Iron Alloy Coated (Galvannealed) By the Hot-
Dip Process
- B32-08 Standard Specification for Solder Metal
- B62-02 Standard Specification for Composition Bronze or
Ounce Metal Castings
- B88-03 Standard Specification for Seamless Copper Water
Tube
- B209-07 Aluminum and Aluminum Alloy Sheet and Plate
- C177-04 Standard Test Method for Steady State Heat Flux
Measurements and Thermal Transmission Properties
by Means of the Guarded Hot Plate Apparatus
- C478-09 Precast Reinforced Concrete Manhole Sections

- C533-07 Calcium Silicate Block and Pipe Thermal
Insulation
- C552-07 Cellular Glass Thermal Insulation
- D3350-08 Polyethylene Plastics Pipe and Fittings
Materials
- C591-08 Unfaced Preformed Rigid Cellular
Polyisocyanurate Thermal Insulation
- D1784-08 Rigid Poly (Vinyl Chloride) (PVC) Compounds and
Chlorinated Poly (Vinyl Chloride) (CPVC)
Compound
- D1785-06 Poly (Vinyl Chloride) (PVC) Plastic Pipe,
Schedules 40, 80 and 120
- D2241-05 Poly (Vinyl Chloride) (PVC) Pressure Rated Pipe
(SDR Series)
- F439-06 Standard Specification for Chlorinated Poly
(Vinyl Chloride) (CPVC) Plastic Pipe
Fittings, Schedule 80
- F441/F441M-02 Standard Specification for Chlorinated Poly
(Vinyl Chloride) (CPVC) Plastic Pipe,
Schedules 40 and 80
- F477-08 Elastomeric Seals Gaskets) for Joining Plastic
Pipe
- American Water Works Association (AWWA):
- C110-08 Ductile Iron and Grey Iron Fittings for Water
- C203-02 Coal Tar Protective Coatings and Linings for
Steel Water Pipe Lines Enamel and Tape Hot
Applied
- American Welding Society (AWS):
- B2.1-02 Standard Welding Procedure Specification
- Copper Development Association, Inc. (CDA):
- CDA A4015-06 Copper Tube Handbook
- Expansion Joint Manufacturer's Association, Inc. (EJMA):
- EMJA-2003 Expansion Joint Manufacturer's Association
Standards, Ninth Edition
- Manufacturers Standardization Society (MSS) of the Valve and Fitting
Industry, Inc.:
- SP-67-02a Butterfly Valves

SP-70-06	.....	Gray Iron Gate Valves, Flanged and Threaded Ends
SP-71-05	.....	Gray Iron Swing Check Valves, Flanged and Threaded Ends
SP-80-08	.....	Bronze Gate, Globe, Angle and Check Valves
SP-85-02	.....	Cast Iron Globe and Angle Valves, Flanged and Threaded Ends
SP-110-96	.....	Ball Valves Threaded, Socket-Welding, Solder Joint, Grooved and Flared Ends
SP-125-00	.....	Gray Iron and Ductile Iron In-line, Spring Loaded, Center-Guided Check Valves

National Sanitation Foundation/American National Standards Institute, Inc. (NSF/ANSI):

14-06	.....	Plastic Piping System Components and Related Materials
50-2009a	.....	Equipment for Swimming Pools, Spas, Hot Tubs and other Recreational Water Facilities - Evaluation criteria for materials, components, products, equipment and systems for use at recreational water facilities
61-2008	.....	Drinking Water System Components - Health Effects

Tubular Exchanger Manufacturers Association: TEMA 9th Edition, 2007

1.6 SPARE PARTS

- A. For mechanical pressed sealed fittings provide tools required for each pipe size used at the facility.

PART 2 - PRODUCTS

2.1 PIPE AND EQUIPMENT SUPPORTS, PIPE SLEEVES, AND WALL AND CEILING PLATES

- A. Provide in accordance with Section 23 05 11, COMMON WORK RESULTS FOR HVAC.

2.2 PIPE AND TUBING

- A. Chilled Water, Heating Hot Water, and Glycol-Water, and Vent Piping:
 Steel: ASTM A53 Grade B, seamless or ERW, Schedule 40.
 Copper water tube option: ASTM B88, Type K or L, hard drawn.
- B. Extension of Domestic Water Make-up Piping: ASTM B88, Type K or L, hard drawn copper tubing.

Cooling Coil Condensate Drain Piping:

1. From fan coil or other terminal units: Copper water tube, ASTM B88, Type L for runouts and Type M for mains.

Pipe supports, including insulation shields, for above ground piping:

Section 23 05 11, COMMON WORK RESULTS FOR HVAC and STEAM GENERATION.

2.3 FITTINGS FOR STEEL PIPE

- A. 50 mm (2 inches) and Smaller: Screwed or welded joints.

Butt welding: ASME B16.9 with same wall thickness as connecting piping.

Forged steel, socket welding or threaded: ASME B16.11.

Screwed: 150 pound malleable iron, ASME B16.3. 125 pound cast iron, ASME B16.4, may be used in lieu of malleable iron. Bushing reduction of a single pipe size, or use of close nipples, is not acceptable.

Unions: ASME B16.39.

Water hose connection adapter: Brass, pipe thread to 20 mm (3/4 inch) garden hose thread, with hose cap nut.

- B. 65 mm (2-1/2 inches) and Larger: Welded or flanged joints. Contractor's option: Grooved mechanical couplings and fittings are optional.

Butt welding fittings: ASME B16.9 with same wall thickness as connecting piping. Elbows shall be long radius type, unless otherwise noted.

Welding flanges and bolting: ASME B16.5:

Water service: Weld neck or slip-on, plain face, with 6 mm (1/8 inch) thick full face neoprene gasket suitable for 104 degrees C (220 degrees F).

- 1) Contractor's option: Convoluted, cold formed 150 pound steel flanges, with teflon gaskets, may be used for water service.

Flange bolting: Carbon steel machine bolts or studs and nuts, ASTM A307, Grade B.

- C. Welded Branch and Tap Connections: Forged steel weldolets, or branchlets and threadolets may be used for branch connections up to one pipe size smaller than the main. Forged steel half-couplings, ASME B16.11 may be used for drain, vent and gage connections.

- D. Grooved Mechanical Pipe Couplings and Fittings (Contractor's Option):

Grooved Mechanical Pipe Couplings and Fittings may be used, with cut or roll grooved pipe, in water service up to 110 degrees C (230 degrees F) in lieu of welded, screwed or flanged connections. All joints must be rigid type.

Grooved mechanical couplings: Malleable iron, ASTM A47 or ductile iron, ASTM A536, fabricated in two or more parts, securely held together by two or more track-head, square, or oval-neck bolts, ASTM A449 and A183.

Gaskets: Rubber product recommended by the coupling manufacturer for the intended service.

Grooved end fittings: Malleable iron, ASTM A47; ductile iron, ASTM A536; or steel, ASTM A53 or A106, designed to accept grooved mechanical couplings. Tap-in type branch connections are acceptable. **2.4 FITTINGS FOR COPPER TUBING**

A. Joints:

Solder Joints: Joints shall be made up in accordance with recommended practices of the materials applied. Apply 95/5 tin and antimony on all copper piping.

Contractor's Option: Mechanical press sealed fittings, double pressed type, NSF 50/61 approved, with EPDM (ethylene propylene diene monomer) non-toxic synthetic rubber sealing elements for up to 65 mm (2-1/2 inch) and below are optional for above ground water piping only.

Mechanically formed tee connection in water and drain piping: Form mechanically extracted collars in a continuous operation by drilling pilot hole and drawing out tube surface to form collar, having a height of not less than three times the thickness of tube wall. Adjustable collaring device shall insure proper tolerance and complete uniformity of the joint. Notch and dimple joining branch tube in a single process to provide free flow where the branch tube penetrates the fitting.

B. Bronze Flanges and Flanged Fittings: ASME B16.24.

C. Fittings: ANSI/ASME B16.18 cast copper or ANSI/ASME B16.22 solder wrought copper.

2.5 FITTINGS FOR PLASTIC PIPING

Schedule 40, socket type for solvent welding.

Schedule 40 PVC drain piping: Drainage pattern.

Chemical feed piping for condenser water treatment: Chlorinated polyvinyl chloride (CPVC), Schedule 80, ASTM F439.

2.6 DIELECTRIC FITTINGS

Provide where copper tubing and ferrous metal pipe are joined.

50 mm (2 inches) and Smaller: Threaded dielectric union, ASME B16.39.

65 mm (2 1/2 inches) and Larger: Flange union with dielectric gasket and bolt sleeves, ASME B16.42.

Temperature Rating, 99 degrees C (210 degrees F).

Contractor's option: On pipe sizes 2" and smaller, screwed end brass ball valves may be used in lieu of dielectric unions.

2.7 SCREWED JOINTS

Pipe Thread: ANSI B1.20.

Lubricant or Sealant: Oil and graphite or other compound approved for the intended service.

2.8 VALVES

- A. Asbestos packing is not acceptable.
- B. All valves of the same type shall be products of a single manufacturer.
- C. Provide chain operators for valves 150 mm (6 inches) and larger when the centerline is located 2400 mm (8 feet) or more above the floor or operating platform.
- D. Shut-Off Valves
 - 1. Ball Valves (Pipe sizes 2" and smaller): MSS-SP 110, screwed or solder connections, brass or bronze body with chrome-plated ball with full port and Teflon seat at 2760 kPa (400 psig) working pressure rating. Provide stem extension to allow operation without interfering with pipe insulation.
- E. Globe and Angle Valves
 - 1. Globe Valves
 - 50 mm (2 inches) and smaller: MSS-SP 80, bronze, 1034 kPa (150 lb.) Globe valves shall be union bonnet with metal plug type disc.
 - 65 mm (2 1/2 inches) and larger: 861 kPa (125 psig), flanged, iron body, bronze trim, MSS-SP-85 for globe valves.
 - 2. Angle Valves:
 - 50 mm (2 inches) and smaller: MSS-SP 80, bronze, 1034 kPa (150 lb.) Angle valves shall be union bonnet with metal plug type disc.
 - 65 mm (2 1/2 inches) and larger: 861 kPa (125 psig), flanged, iron body, bronze trim, MSS-SP-85 for angle.
- F. Check Valves
 - 1. Swing Check Valves:
 - a. 50 mm (2 inches) and smaller: MSS-SP 80, bronze, 1034 kPa (150 lb.), 45 degree swing disc.

- b. 65 mm (2 1/2 inches) and larger: 861 kPa (125 psig), flanged, iron body, bronze trim, MSS-SP-71 for check valves.
2. Non-Slam or Silent Check Valve: Spring loaded double disc swing check or internally guided flat disc lift type check for bubble tight shut-off. Provide where check valves are shown in chilled water and hot water piping. Check valves incorporating a balancing feature may be used.
- Body: MSS-SP 125 cast iron, ASTM A126, Class B, or steel, ASTM A216, Class WCB, or ductile iron, ASTM 536, flanged, grooved, or wafer type.
- Seat, disc and spring: 18-8 stainless steel, or bronze, ASTM B62. Seats may be elastomer material.
- G. Water Flow Balancing Valves: For flow regulation and shut-off. Valves shall be line size rather than reduced to control valve size.
- Ball or Globe style valve.
- A dual purpose flow balancing valve and adjustable flow meter, with bronze or cast iron body, calibrated position pointer, valved pressure taps or quick disconnects with integral check valves and preformed polyurethane insulating enclosure.
- Provide a readout kit including flow meter, readout probes, hoses, flow charts or calculator, and carrying case.
- H. Automatic Balancing Control Valves: Factory calibrated to maintain constant flow (plus or minus five percent) over system pressure fluctuations of at least 10 times the minimum required for control. Provide standard pressure taps and four sets of capacity charts. Valves shall be line size and be one of the following designs:
- Gray iron (ASTM A126) or brass body rated 1205 kPa (175 psig) at 93 degrees C (200 degrees F), with stainless steel piston and spring.
- Brass or ferrous body designed for 2067 kPa (300 psig) service at 121 degrees C (250 degrees F), with corrosion resistant, tamper proof, self-cleaning piston/spring assembly that is easily removable for inspection or replacement.
- Combination assemblies containing ball type shut-off valves, unions, flow regulators, strainers with blowdown valves and pressure temperature ports shall be acceptable.
- Provide a readout kit including flow meter, probes, hoses, flow charts and carrying case.

- I. Manual Radiator/Convactor Valves: Brass, packless, with position indicator.

2.9 WATER FLOW MEASURING DEVICES

- A. Minimum overall accuracy plus or minus three percent over a range of 70 to 110 percent of design flow. Select devices for not less than 110 percent of design flow rate.
- B. Venturi Type: Bronze, steel, or cast iron with bronze throat, with valved pressure sensing taps upstream and at the throat.
- C. Wafer Type Circuit Sensor: Cast iron wafer-type flow meter equipped with readout valves to facilitate the connecting of a differential pressure meter. Each readout valve shall be fitted with an integral check valve designed to minimize system fluid loss during the monitoring process.
- D. Self-Averaging Annular Sensor Type: Brass or stainless steel metering tube, shutoff valves and quick-coupling pressure connections. Metering tube shall be rotatable so all sensing ports may be pointed downstream when unit is not in use.
- E. Insertion Turbine Type Sensor: Section 23 09 23, DIRECT-DIGITAL CONTROL SYSTEM FOR HVAC.
- F. Flow Measuring Device Identification:
 - Metal tag attached by chain to the device.
 - Include meter or equipment number, manufacturer's name, meter model, flow rate factor and design flow rate in l/m (gpm).
- G. Portable Water Flow Indicating Meters:
 - Minimum 150 mm (6 inch) diameter dial, forged brass body, beryllium-copper bellows, designed for 1205 kPa (175 psig) working pressure at 121 degrees C (250 degrees F).
 - Bleed and equalizing valves.
 - Vent and drain hose and two 3000 mm (10 feet) lengths of hose with quick disconnect connections.
 - Factory fabricated carrying case with hose compartment and a bound set of capacity curves showing flow rate versus pressure differential.
 - Provide one portable meter for each range of differential pressure required for the installed flow devices.

- H. Permanently Mounted Water Flow Indicating Meters: Minimum 150 mm (6 inch) diameter, or 450 mm (18 inch) long scale, for 120 percent of design flow rate, direct reading in lps (gpm), with three valve manifold and two shut-off valves.

2.10 STRAINERS

A. Y Type.

1. Screens: Bronze, monel metal or 18-8 stainless steel, free area not less than 2-1/2 times pipe area, with perforations as follows: 1.1 mm (0.045 inch) diameter perforations for 100 mm (4 inches) and larger: 3.2 mm (0.125 inch) diameter perforations.

2.11 FLEXIBLE CONNECTORS FOR WATER SERVICE

A. Flanged Spool Connector:

1. Single arch or multiple arch type. Tube and cover shall be constructed of chlorobutyl elastomer with full faced integral flanges to provide a tight seal without gaskets. Connectors shall be internally reinforced with high strength synthetic fibers impregnated with rubber or synthetic compounds as recommended by connector manufacturer, and steel reinforcing rings.
2. Working pressures and temperatures shall be as follows:
Connector sizes 50 mm to 100 mm (2 inches to 4 inches), 1137 kPa (165psig) at 121 degrees C (250 degrees F).
Connector sizes 125 mm to 300 mm (5 inches to 12 inches), 965 kPa (140 psig) at 121 degrees C (250 degrees F).
3. Provide ductile iron retaining rings and control units.

B. Mechanical Pipe Couplings:

See other fittings specified under Part 2,

PRODUCTS. 2.12 EXPANSION JOINTS

Factory built devices, inserted in the pipe lines, designed to absorb axial cyclical pipe movement which results from thermal expansion and contraction. This includes factory-built or field-fabricated guides located along the pipe lines to restrain lateral pipe motion and direct the axial pipe movement into the expansion joints.

Manufacturing Quality Assurance: Conform to Expansion Joints

Manufacturers Association Standards.

Bellows - Internally Pressurized Type:

Multiple corrugations of Type 304 or Type A240-321 stainless steel.
Internal stainless steel sleeve entire length of bellows.

External cast iron equalizing rings for services exceeding 340 kPa (50 psig).

Welded ends.

Design shall conform to standards of EJMA and ASME B31.1.

External tie rods designed to withstand pressure thrust force upon anchor failure if one or both anchors for the joint are at change in direction of pipeline.

Integral external cover.

D. Bellows - Externally Pressurized Type:

Multiple corrugations of Type 304 stainless steel.

Internal and external guide integral with joint.

Design for external pressurization of bellows to eliminate squirm.

Welded ends.

Conform to the standards of EJMA and ASME B31.1.

Threaded connection at bottom, 25 mm (one inch) minimum, for drain or drip point.

Integral external cover and internal sleeve.

E. Expansion Compensators:

Corrugated bellows, externally pressurized, stainless steel or bronze.

Internal guides and anti-torque devices.

Threaded ends.

External shroud.

Conform to standards of EJMA.

F. Expansion Joint (Contractor's Option): 2415 kPa (350 psig) maximum working pressure, steel pipe fitting consisting of telescoping body and slip-pipe sections, PTFE modified polyphenylene sulfide coated slide section, with grooved ends, suitable for axial end movement to 75 mm (3 inch).

G. Expansion Joint Identification: Provide stamped brass or stainless steel nameplate on each expansion joint listing the manufacturer, the allowable movement, flow direction, design pressure and temperature, date of manufacture, and identifying the expansion joint by the identification number on the contract drawings.

H. Guides: Provide factory-built guides along the pipe line to permit axial movement only and to restrain lateral and angular movement. Guides must be designed to withstand a minimum of 15 percent of the

axial force which will be imposed on the expansion joints and anchors. Field-built guides may be used if detailed on the contract drawings. I. Supports: Provide saddle supports and frame or hangers for heat exchanger. Construct supports from steel, weld joints.

2.13 HYDRONIC SYSTEM COMPONENTS

A. Heat Exchanger (Water to Water): Shell and tube type, U-bend removable tube bundle, heating fluid in shell, heated fluid in tubes, equipped with support cradles.

1. Maximum tube velocity: 2.3 m/s (7.5 feet per second).

2. Tube fouling factor: TEMA Standards, but not less than 0.001.

3. Materials:

Shell: Steel.

Tube sheet and tube supports: Steel or brass.

Tubes: 20 mm (3/4 inch) OD copper.

Head or bonnet: Cast iron or steel.

Gages shall be metal or phenolic case, 59 mm (2 1/2 inches) in diameter, 6 mm (1/4 inch) NPT bottom connection, white dial with black or blue graduations and pointer, clear glass or acrylic plastic window, glycerin filled as manufactured by TIF or approved equal.

4. Construction: In accordance with ASME Pressure Vessel Code for 861 kPa (125 psig) working pressure for shell and tubes.

Provide manufacturer's certified data report, Form No. U-1.

B. Plate and Frame Heat Exchanger:

Fixed frame with bolted removable corrugated channel plate assembly, ASME code stamped for 150 psig working pressure.

Corrugated channel plates shall be type 316 or 304 stainless steel.

Channel plate ports to be double gasketed to prevent mixing or cross-contamination of hot side and cold side fluids. Gaskets to be EPPM.

Channel plate carrying bars to be carbon steel with zinc yellow chromate finish.

Fixed frame plates and moveable pressure plates to be corrosion resistant epoxy painted carbon steel.

Piping connections 2" and smaller to be carbon steel NPT tapings.

Piping connections 4" and larger to be studed port design to accept ANSI flange connections. Connection ports to be integral to the frame or pressure plate.

Finished units to be provided with OSHA required, formed aluminum splash guards to enclose exterior channel plate and gasket surfaces. Provide two sets of replacement gaskets and provide one set of wrenches for disassembly of plate type heat exchangers.

Performance: As scheduled on drawings.

Optional Heat Transfer Package: In lieu of field erected individual components, the Contractor may provide a factory or shop assembled package of converters, pumps, and other components supported on a welded steel frame. Refer to Section 23 22 13, STEAM and STEAM CONDENSATE HEATING PIPING, for additional requirements

Air Purger: Cast iron or fabricated steel, 861 kPa (125 psig) water working pressure, for in-line installation.

Tangential Air Separator: ASME Pressure Vessel Code construction for 861 kPa (125 psig) working pressure, flanged tangential inlet and outlet connection, internal perforated stainless steel air collector tube designed to direct released air into expansion tank, bottom blowdown connection. Provide Form No. U-1. If scheduled on the drawings, provide a removable stainless steel strainer element having 5 mm (3/16 inch) perforations and free area of not less than five times the cross-sectional area of connecting piping.

Diaphragm Type Pre-Pressurized Expansion Tank: ASME Pressure Vessel Code construction for 861 kPa (125 psig) working pressure, welded steel shell, rust-proof coated, with a flexible elastomeric diaphragm suitable for a maximum operating temperature of 116 degrees C (240 degrees F). Provide Form No. U-1. Tank shall be equipped with system connection, drain connection, standard air fill valve and be factory pre-charged to a minimum of 83 kPa (12 psig).

Closed Expansion (Compression) Tank: ASME Pressure Vessel Code construction for 861 kPa (125 psig) working pressure, steel, rust-proof coated. Provide gage glass, with protection guard, and angle valves with tapped openings for drain (bottom) and plugged vent (top). Provide Form No. U-1.

1. Horizontal tank: Provide cradle supports and following accessories:
 - a. Air control tank fittings: Provide in each expansion tank to facilitate air transfer from air separator, or purger, into tank while restricting gravity circulation. Fitting shall include an integral or separate air vent tube, cut to length of about 2/3 of

tank diameter, to allow venting air from the tank when establishing the initial water level in the tank.

- b. Tank drainer-air charger: Shall incorporate a vent tube, cut to above 2/3 of tank diameter, and drain valve with hose connection draining and recharging with air.

2. Vertical floor-mounted expansion tank: Provide gage glass, system or drain connection (bottom) and air charging (top) tappings. Provide gate valve and necessary adapters for charging system. Tank support shall consist of floor mounted base ring with drain access opening or four angle iron legs with base plates.

Pressure Reducing Valve (Water): Diaphragm or bellows operated, spring loaded type, with minimum adjustable range of 28 kPa (4 psig) above and below set point. Bronze, brass or iron body and bronze, brass or stainless steel trim, rated 861 kPa (125 psig) working pressure at 107 degrees C (225 degrees F).

Pressure Relief Valve: Bronze or iron body and bronze or stainless steel trim, with testing lever. Comply with ASME Code for Pressure Vessels, Section 8, and bear ASME stamp.

Automatic Air Vent Valves: Cast iron or semi-steel body, 1034 kPa (150 psig) working pressure, stainless steel float, valve, valve seat and mechanism, minimum 15 mm (1/2 inch) water connection and 6 mm (1/4 inch) air outlet. Air outlet shall be piped to the nearest floor drain.

2.14 WATER FILTERS AND POT CHEMICAL FEEDERS

See section 23 25 00, HVAC WATER TREATMENT.

2.15 GAGES, PRESSURE AND COMPOUND

ASME B40.100, Accuracy Grade 1A, (pressure, vacuum, or compound for air, oil or water), initial mid-scale accuracy 1 percent of scale (Qualify grade), metal or phenolic case, 59 mm (2-1/2 inches) in diameter, 6 mm (1/4 inch) NPT bottom connection, white dial with black or blue graduations and pointer, clear glass or acrylic plastic window, suitable for board mounting, glycerin filled as manufactured by TIF or approved equal. Provide red "set hand" to indicate normal working pressure.

Provide brass lever handle union cock. Provide brass/bronze pressure snubber for gages in water service.

Range of Gages: Provide range equal to at least 130 percent of normal operating range.

2.16 PRESSURE/TEMPERATURE TEST PROVISIONS

Pete's Plug: 6 mm (1/4 inch) MPT by 75 mm (3 inches) long, brass body and cap, with retained safety cap, nordel self-closing valve cores, permanently installed in piping where shown, or in lieu of pressure gage test connections shown on the drawings.

Provide one each of the following test items to the Resident Engineer:

6 mm (1/4 inch) FPT by 3 mm (1/8 inch) diameter stainless steel pressure gage adapter probe for extra long test plug. PETE'S 500 XL is an example.

90 mm (3-1/2 inch) diameter, one percent accuracy, compound gage, -- 100 kPa (30 inches) Hg to 700 kPa (100 psig) range.

0 - 104 degrees C (220 degrees F) pocket thermometer one-half degree accuracy, 25 mm (one inch) dial, 125 mm (5 inch) long stainless steel stem, plastic case.

2.17 THERMOMETERS

"5" bimetal thermometer with stainless steel case and adjustable angle connection. Wika T1.52 or approved equal.

Case: Chrome plated brass or aluminum with enamel finish.

Scale: Not less than 225 mm (9 inches), range as described below, two degree graduations.

Separable Socket (Well): Brass, extension neck type to clear pipe insulation.

Scale ranges:

Chilled Water and Glycol-Water: 0-38 degrees C (32-100 degrees F).

Hot Water and Glycol-Water: -1 - 116 degrees C (30-240 degrees F).

2.18 FIRESTOPPING MATERIAL

Refer to Section 23 05 11, COMMON WORK RESULTS FOR HVAC.

2.19 ELECTRICAL HEAT TRACING SYSTEMS

A. Systems shall meet requirements of the National Electrical Code (NEC), Section 427.

B. Provide tracing for outdoor piping subject to freezing temperatures (Below 38 degrees F) as follows:

Make-up water

Chilled water// hot water// piping at units exposed to the weather.

Domestic water lines exposed to weather.

C. Heat tracing shall be provided to the extent shown on the drawings (Floor plans and Elevations). Heat tracing shall extend below grade to below the defined frost line.

D. Heating Cable: Flexible, parallel circuit construction consisting of a continuous self-limiting resistance, conductive inner core material between two parallel copper bus wires, designed for cut-to-length at the job site and for wrapping around valves and complex fittings. Self-regulation shall prevent overheating and burnouts even where the cable overlaps itself.

Provide end seals at ends of circuits. Wire at the ends of the circuits is not to be tied together.

Provide sufficient cable, as recommended by the manufacturer, to keep the pipe surface at 2.2 degrees C (36 degrees F) minimum during winter outdoor design temperature, but not less than the following:

75 mm (3 inch) pipe and smaller with 25 mm (1 inch) thick insulation: 4 watts per foot of pipe.

100 mm (4 inch) pipe and larger 38 mm (1-1/2 inch) thick insulation: 8 watts per feet of pipe.

E. Electrical Heating Tracing Accessories:

Power supply connection fitting and stainless steel mounting brackets.

Provide stainless steel worm gear clamp to fasten bracket to pipe.

13 mm (1/2 inch) wide fiberglass reinforced pressure sensitive cloth tape to fasten cable to pipe at 300 mm (12 inch) intervals.

Pipe surface temperature control thermostat: Cast aluminum, NEMA 4 (watertight) enclosure, 13 mm (1/2 inch) NPT conduit hub, SPST switch rated 20 amps at 480 volts AC, with capillary and copper bulb sensor. Set thermostat to maintain pipe surface temperature at not less than 1.1 degrees C (34 degrees F).

Signs: Manufacturer's standard (NEC Code), stamped "ELECTRIC TRACED" located on the insulation jacket at 3000 mm (10 feet) intervals along the pipe on alternating sides.

PART 3 - EXECUTION

3.1 GENERAL

A. The drawings show the general arrangement of pipe and equipment but do not show all required fittings and offsets that may be necessary to connect pipes to equipment, fan-coils, coils, radiators, etc., and to coordinate with other trades. Provide all necessary fittings, offsets and pipe runs based on field measurements and at no additional cost to the government. Coordinate with other trades for space available and relative location of HVAC equipment and accessories to be connected on

ceiling grid. Pipe location on the drawings shall be altered by contractor where necessary to avoid interferences and clearance difficulties.

Store materials to avoid excessive exposure to weather or foreign materials. Keep inside of piping relatively clean during installation and protect open ends when work is not in progress.

Support piping securely. Refer to PART 3, Section 23 05 11, COMMON WORK RESULTS FOR HVAC and STEAM GENERATION. Install heat exchangers at height sufficient to provide gravity flow of condensate to the flash tank and condensate pump.

Install piping generally parallel to walls and column center lines, unless shown otherwise on the drawings. Space piping, including insulation, to provide 25 mm (one inch) minimum clearance between adjacent piping or other surface. Unless shown otherwise, slope drain piping down in the direction of flow not less than 25 mm (one inch) in 12 m (40 feet). Provide eccentric reducers to keep bottom of sloped piping flat.

Locate and orient valves to permit proper operation and access for maintenance of packing, seat and disc. Generally locate valve stems in overhead piping in horizontal position. Provide a union adjacent to one end of all threaded end valves. Control valves usually require reducers to connect to pipe sizes shown on the drawing. Install butterfly valves with the valve open as recommended by the manufacturer to prevent binding of the disc in the seat.

Offset equipment connections to allow valving off for maintenance and repair with minimal removal of piping. Provide flexibility in equipment connections and branch line take-offs with 3-elbow swing joints where noted on the drawings.

Tee water piping runouts or branches into the side of mains or other branches. Avoid bull-head tees, which are two return lines entering opposite ends of a tee and exiting out the common side.

Provide manual or automatic air vent at all piping system high points and drain valves at all low points. Install piping to floor drains from all automatic air vents.

Connect piping to equipment as shown on the drawings. Install components furnished by others such as:

1. Water treatment pot feeders and condenser water treatment systems.

2. Flow elements (orifice unions), control valve bodies, flow switches, pressure taps with valve, and wells for sensors.

Thermometer Wells: In pipes 65 mm (2-1/2 inches) and smaller increase the pipe size to provide free area equal to the upstream pipe area.

Firestopping: Fill openings around uninsulated piping penetrating floors or fire walls, with firestop material. For firestopping insulated piping refer to Section 23 07 11, HVAC, PLUMBING, and BOILER PLANT INSULATION.

Where copper piping is connected to steel piping, provide dielectric connections.

3.2 PIPE JOINTS

Welded: Beveling, spacing and other details shall conform to ASME B31.1 and AWS B2.1. See Welder's qualification requirements under "Quality Assurance" in Section 23 05 11, COMMON WORK RESULTS FOR HVAC and STEAM GENERATION.

Screwed: Threads shall conform to ASME B1.20; joint compound shall be applied to male threads only and joints made up so no more than three threads show. Coat exposed threads on steel pipe with joint compound, or red lead paint for corrosion protection.

Mechanical Joint: Pipe grooving shall be in accordance with joint manufacturer's specifications. Lubricate gasket exterior including lips, pipe ends and housing interiors to prevent pinching the gasket during installation. Lubricant shall be as recommended by coupling manufacturer.

125 Pound Cast Iron Flange (Plain Face): Mating flange shall have raised face, if any, removed to avoid overstressing the cast iron flange.

Solvent Welded Joints: As recommended by the manufacturer.

3.3 EXPANSION JOINTS (BELLOWS AND SLIP TYPE)

Anchors and Guides: Provide type, quantity and spacing as recommended by manufacturer of expansion joint and as shown. A professional engineer shall verify in writing that anchors and guides are properly designed for forces and moments which will be imposed.

Cold Set: Provide setting of joint travel at installation as recommended by the manufacturer for the ambient temperature during the installation.

Preparation for Service: Remove all apparatus provided to restrain joint during shipping or installation. Representative of manufacturer shall visit the site and verify that installation is proper.

Access: Expansion joints must be located in readily accessible space. Locate joints to permit access without removing piping or other devices. Allow clear space to permit replacement of joints and to permit access to devices for inspection of all surfaces and for adding.

3.4 SEISMIC BRACING ABOVEGROUND PIPING

Provide in accordance with Section 13 05 41, SEISMIC RESTRAINT REQUIREMENTS FOR NON-STRUCTURAL COMPONENTS.

3.5 LEAK TESTING ABOVEGROUND PIPING

Inspect all joints and connections for leaks and workmanship and make corrections as necessary, to the satisfaction of the Resident Engineer. Tests may be either of those below, or a combination, as approved by the Resident Engineer.

An operating test at design pressure, and for hot systems, design maximum temperature.

A hydrostatic test at 1.5 times design pressure. For water systems the design maximum pressure would usually be the static head, or expansion tank maximum pressure, plus pump head. Factory tested equipment (convertors, exchangers, coils, etc.) need not be field tested. Isolate equipment where necessary to avoid excessive pressure on mechanical seals and safety devices.

3.6 FLUSHING AND CLEANING PIPING SYSTEMS

A. Water Piping: Clean systems as recommended by the suppliers of chemicals specified in Section 23 25 00, HVAC WATER TREATMENT.

1. Initial flushing: Remove loose dirt, mill scale, metal chips, weld beads, rust, and like deleterious substances without damage to any system component. Provide temporary piping or hose to bypass coils, control valves, exchangers and other factory cleaned equipment unless acceptable means of protection are provided and subsequent inspection of hide-out areas takes place. Isolate or protect clean system components, including pumps and pressure vessels, and remove any component which may be damaged. Open all valves, drains, vents and strainers at all system levels. Remove plugs, caps, spool pieces, and components to facilitate early debris discharge from system. Sectionalize system to obtain debris carrying velocity of 1.8 m/S (6 feet per second), if possible. Connect dead-end supply

and return headers as necessary. Flush bottoms of risers. Install temporary strainers where necessary to protect down-stream equipment. Supply and remove flushing water and drainage by various type hose, temporary and permanent piping and Contractor's booster pumps. Flush until clean as approved by the Resident Engineer.

Cleaning: Using products supplied in Section 23 25 00, HVAC WATER TREATMENT, circulate systems at normal temperature to remove adherent organic soil, hydrocarbons, flux, pipe mill varnish, pipe joint compounds, iron oxide, and like deleterious substances not removed by flushing, without chemical or mechanical damage to any system component. Removal of tightly adherent mill scale is not required. Keep isolated equipment which is "clean" and where dead-end debris accumulation cannot occur. Sectionalize system if possible, to circulate at velocities not less than 1.8 m/S (6 feet per second). Circulate each section for not less than four hours. Blow-down all strainers, or remove and clean as frequently as necessary. Drain and prepare for final flushing.

Final Flushing: Return systems to conditions required by initial flushing after all cleaning solution has been displaced by clean make-up. Flush all dead ends and isolated clean equipment. Gently operate all valves to dislodge any debris in valve body by throttling velocity. Flush for not less than one hour.

3.7 WATER TREATMENT

Install water treatment equipment and provide water treatment system piping.

Close and fill system as soon as possible after final flushing to minimize corrosion.

Charge systems with chemicals specified in Section 23 25 00, HVAC WATER TREATMENT.

Utilize this activity, by arrangement with the Resident Engineer, for instructing VA operating personnel.

3.8 ELECTRIC HEAT TRACING

Install tracing as recommended by the manufacturer.

Coordinate electrical connections. **3.9**

OPERATING AND PERFORMANCE TEST AND INSTRUCTION

Refer to PART 3, Section 23 05 11, COMMON WORK RESULTS FOR HVAC.

Adjust red set hand on pressure gages to normal working pressure. -

- - E N D - - -

RORSECTION 23 21 23
HYDRONIC PUMPS

PART 1 - GENERAL

1.1 DESCRIPTION

A. Hydronic pumps for Heating, Ventilating and Air Conditioning.

1.2 RELATED WORK

Section 01 00 00, GENERAL REQUIREMENTS.

Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, and SAMPLES.

Section 13 05 41, SEISMIC RESTRAINT REQUIREMENTS FOR NON-STRUCTURAL COMPONENTS.

Section 23 05 11, COMMON WORK RESULTS FOR HVAC.

Section 23 05 41, NOISE AND VIBRATION CONTROL FOR HVAC PIPING and EQUIPMENT.

Section 23 21 13, HYDRONIC PIPING.

Section 23 05 12, GENERAL MOTOR REQUIREMENTS FOR HVAC and STEAM GENERATION EQUIPMENT.

Section 26 29 11, LOW-VOLTAGE MOTOR STARTERS.

1.3 QUALITY ASSURANCE

Refer to Paragraph, QUALITY ASSURANCE, in Section 23 05 11, COMMON WORK RESULTS FOR HVAC and STEAM GENERATION.

Design Criteria:

Pumps design and manufacturer shall conform to Hydraulic Institute Standards.

Pump sizes, capacities, pressures, operating characteristics and efficiency shall be as scheduled.

Head-capacity curves shall slope up to maximum head at shut-off. Curves shall be relatively flat for closed systems. Select pumps near the midrange of the curve, so the design capacity falls to the left of the best efficiency point, to allow a cushion for the usual drift to the right in operation, without approaching the pump curve end point and possible cavitation and unstable operation. Select pumps for open systems so that required net positive suction head (NPSHR) does not exceed the net positive head available (NPSHA).

Pump Driver: Furnish with pump. Size shall be non-overloading at any point on the head-capacity curve, including in a parallel or series pumping installation with one pump in operation.

Provide all pumps with motors, impellers, drive assemblies, bearings, coupling guard and other accessories specified. Statically and dynamically balance all rotating parts.

Furnish each pump and motor with a nameplate giving the manufacturers name, serial number of pump, capacity in GPM and head in feet at design condition, horsepower, voltage, frequency, speed and full load current and motor efficiency.

Test all pumps before shipment. The manufacturer shall certify all pump ratings.

After completion of balancing, provide replacement of impellers or trim impellers to provide specified flow at actual pumping head, as installed.

C. Allowable Vibration Tolerance for Pump Units: Section 23 05 41, NOISE AND VIBRATION CONTROL FOR HVAC PIPING and EQUIPMENT.

1.4 SUBMITTALS

A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, and SAMPLES.

B. Manufacturer's Literature and Data:

Pumps and accessories.

Motors and drives.

Variable speed motor controllers.

C. Manufacturer's installation, maintenance and operating instructions, in accordance with Section 23 05 11, COMMON WORK RESULTS FOR HVAC.

D. Characteristic Curves: Head-capacity, efficiency-capacity, brake horsepower-capacity, and NPSHR-capacity for each pump and for combined pumps in parallel or series service. Identify pump and show fluid pumped, specific gravity, pump speed and curves plotted from zero flow to maximum for the impeller being furnished and at least the maximum diameter impeller that can be used with the casing.

1.5 APPLICABLE PUBLICATIONS

The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only:

American Iron and Steel Institute (AISI):

AISI 1045Cold Drawn Carbon Steel Bar, Type 1045

AISI 416Type 416 Stainless Steel

American National Standards Institute (ANSI):

ANSI B15.1-00(R2008) Safety Standard for Mechanical Power
Transmission Apparatus

ANSI B16.1-05 Cast Iron Pipe Flanges and Flanged Fittings,
Class 25, 125, 250 and 800

American Society for Testing and Materials (ASTM):

A48-03 (2008) Standard Specification for Gray Iron Castings
 B62-2009 Standard Specification for Composition Bronze or
 Ounce Metal Castings

E. Maintenance and Operating Manuals in accordance with Section 01 00
 00, General Requirements.

1.6 DEFINITIONS

Capacity: Liters per second (L/s) (Gallons per minute (GPM) of the fluid pumped.

Head: Total dynamic head in kPa (feet) of the fluid pumped.

Flat head-capacity curve: Where the shutoff head is less than 1.16 times the head at the best efficiency point.

1.7 SPARE MATERIALS

A. Furnish one spare seal and casing gasket for each pump to the COTR.

PART 2 - PRODUCTS

2.1 CENTRIFUGAL PUMPS, BRONZE FITTED

A. General:

Provide pumps that will operate continuously without overheating bearings or motors at every condition of operation on the pump curve, or produce noise audible outside the room or space in which installed.

Provide pumps of size, type and capacity as indicated, complete with electric motor and drive assembly, unless otherwise indicated.

Design pump casings for the indicated working pressure and factory test at 1 1/2 times the designed pressure.

Provide pumps of the same type, the product of a single manufacturer, with pump parts of the same size and type interchangeable.

General Construction Requirements

Balance: Rotating parts, statically and dynamically.

Construction: To permit servicing without breaking piping or motor connections.

Pump Motors: Provide high efficiency motors, inverter duty for variable speed service. Refer to Section 23 05 12, GENERAL MOTOR REQUIREMENTS FOR HVAC and STEAM GENERATION EQUIPMENT. Motors shall be Open Drip Proof and operate at 1750 rpm unless noted otherwise.

Heating pumps shall be suitable for handling water to 225°F.

Provide coupling guards that meet ANSI B15.1, Section 8 and OSHA requirements.

Pump Connections: Flanged.

Pump shall be factory tested.

h. Performance: As scheduled on the Contract Drawings.

5. Variable Speed Pumps:

The pumps shall be the type shown on the drawings and specified herein flex coupled to an open drip-proof motor.

Variable Speed Motor Controllers: Refer to Section 26 29 11, LOW-VOLTAGE MOTOR STARTERS and to Section 23 05 11, COMMON WORK RESULTS FOR HVAC paragraph, Variable Speed Motor Controllers. Furnish controllers with pumps and motors.

Pump operation and speed control shall be as shown on the drawings.

B. In-Line Type:

Casing and Bearing Housing: Close-grained cast iron, ASTM A48.

Casing Wear Rings: Bronze.

Suction and Discharge: Plain face flange, 850 kPa (125 psig), ANSI B16.1.

Casing Vent: Manual brass cock at high point.

Casing Drain and Gage Taps: 15 mm (1/2-inch) plugged connections minimum size.

Impeller: Bronze, ASTM B62, enclosed type, keyed to shaft.

Shaft: Steel, AISI Type 1045 or stainless steel.

Shaft Seal: Manufacturer's standard mechanical type to suit pressure and temperature and fluid pumped.

Shaft Sleeve: Bronze or stainless steel.

Motor: Furnish with pump. Refer to Section 23 05 12, GENERAL MOTOR REQUIREMENTS FOR HVAC AND STEAM GENERATION EQUIPMENT.

Provide line sized shut-off valve and suction strainer, maintain manufacturer recommended straight pipe length on pump suction (with blow down valve). Contractor option: Provide suction diffuser as follows:

Body: Cast iron with steel inlet vanes and combination diffuser-strainer-orifice cylinder with 5 mm (3/16-inch) diameter openings for pump protection. Provide taps for strainer blowdown and gage connections.

Provide adjustable foot support for suction piping.

Strainer free area: Not less than five times the suction piping.

Provide disposable start-up strainer.

PART 3 - EXECUTION

3.1 INSTALLATION

Follow manufacturer's written instructions for pump mounting and start-up. Access/Service space around pumps shall not be less than minimum space recommended by pumps manufacturer.

Provide drains for bases and seals for base mounted pumps, piped to and discharging into floor drains.

Coordinate location of thermometer and pressure gauges as per Section 23 21 13, HYDRONIC PIPING.

3.2 START-UP

Verify that the piping system has been flushed, cleaned and filled.

Lubricate pumps before start-up.

Prime the pump, vent all air from the casing and verify that the rotation is correct. To avoid damage to mechanical seals, never start or run the pump in dry condition.

Verify that correct size heaters-motor over-load devices are installed for each pump controller unit.

Field modifications to the bearings and or impeller (including trimming) are not permitted. If the pump does not meet the specified vibration tolerance send the pump back to the manufacturer for a replacement pump. All modifications to the pump shall be performed at the factory.

Ensure the disposable strainer is free of debris prior to testing and balancing of the hydronic system.

After several days of operation, replace the disposable start-up strainer with a regular strainer in the suction diffuser.

- - - E N D - - -

THIS PAGE INTENTIONALLY LEFT BLANK

SECTION 23 25 00
HVAC WATER TREATMENT

PART 1 - GENERAL

1.1 DESCRIPTION

A. This section specifies cleaning and treatment of circulating HVAC water systems, including the following.

Cleaning compounds.

Chemical treatment for closed loop heat transfer systems.

Glycol-water heat transfer systems.

1.2 RELATED WORK

Test requirements and instructions on use of equipment/system: Section 01 00 00, GENERAL REQUIREMENTS.

General mechanical requirements and items, which are common to more than one section of Division 23: Section 23 05 11, COMMON WORK RESULTS FOR HVAC and STEAM GENERATION.

Piping and valves: Section 23 21 13, HYDRONIC PIPING.

1.3 QUALITY ASSURANCE

Refer to paragraph, QUALITY ASSURANCE in Section 23 05 11, COMMON WORK RESULTS FOR HVAC and STEAM GENERATION.

Technical Services: Provide the services of an experienced water treatment chemical engineer or technical representative to direct flushing, cleaning, pre-treatment, training, debugging, and acceptance testing operations; direct and perform chemical limit control during construction period and monitor systems for a period of 12 months after acceptance, including not less than 6 service calls and written status reports. Emergency calls are not included. Minimum service during construction/start-up shall be 6 hours.

Chemicals: Chemicals shall be non-toxic approved by local authorities and meeting applicable EPA requirements.

1.4 SUBMITTALS

A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA.

B. Manufacturer's Literature and Data including:

Cleaning compounds and recommended procedures for their use.

Chemical treatment for closed systems, including installation and operating instructions.

Glycol-water system materials, equipment, and installation.

C. Water analysis verification.

Materials Safety Data Sheet for all proposed chemical compounds, based on U.S. Department of Labor Form No. L5B-005-4.

Maintenance and operating instructions in accordance with Section 01 00 00, GENERAL REQUIREMENTS.

1.5 APPLICABLE PUBLICATIONS

The publication listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.

National Fire Protection Association (NFPA):

70-2008 National Electric Code (NEC)

American Society for Testing and Materials (ASTM):

F441/F441M-02 (2008)....Standard Specification for Chlorinated Poly (Vinyl Chloride) (CPVC) Plastic Pipe, Schedules 40 and 80

PART 2 - PRODUCTS

2.1 CLEANING COMPOUNDS

Alkaline phosphate or non-phosphate detergent/surfactant/specific to remove organic soil, hydrocarbons, flux, pipe mill varnish, pipe compounds, iron oxide, and like deleterious substances, with or without inhibitor, suitable for system wetted metals without deleterious effects.

All chemicals to be acceptable for discharge to sanitary sewer. Refer to Section 23 21 13, HYDRONIC PIPING, PART 3, for flushing and cleaning procedures.

2.2 CHEMICAL TREATMENT FOR CLOSED LOOP SYSTEMS

Inhibitor: Provide sodium nitrite/borate, molybdate-based inhibitor or other approved compound suitable for make-up quality and make-up rate and which will cause or enhance bacteria/corrosion problems or mechanical seal failure due to excessive total dissolved solids. Shot feed manually. Maintain inhibitor residual as determined by water treatment laboratory, taking into consideration residual and temperature effect on pump mechanical seals.

pH Control: Inhibitor formulation shall include adequate buffer to maintain pH range of 8.0 to 10.5.

Performance: Protect various wetted, coupled, materials of construction including ferrous, and red and yellow metals. Maintain system essentially free of scale, corrosion, and fouling. Corrosion rate of following metals shall not exceed specified mills per year penetration;

ferrous, 0-2; brass, 0-1; copper, 0-1. Inhibitor shall be stable at equipment skin surface temperatures and bulk water temperatures of not less than 121 degrees C (250 degrees F) and 52 degrees C (125 degrees Fahrenheit) respectively. Heat exchanger fouling and capacity reduction shall not exceed that allowed by fouling factor 0.0005.

Pot Feeder: By-pass type, complete with necessary shut off valves, drain and air release valves, and system connections, for introducing chemicals into system, cast iron or steel tank with funnel or large opening on top for easy chemical addition. Feeders shall be 18.9 L (five gallon) minimum capacity at 860 kPa (125 psig) minimum working pressure.

Side stream Water Filter for Closed Loop Systems: Stainless steel housing, and polypropylene filter media with polypropylene core. Filter media shall be compatible with antifreeze and water treatment chemicals used in the system. Replaceable filter cartridges for sediment removal service with minimum 20 micrometer particulate at 98 percent efficiency for approximately five (5) percent of system design flow rate. Filter cartridge shall have a maximum pressure drop of 13.8 kPa (2 psig) at design flow rate when clean, and maximum pressure drop of 172 kPa (25 psig) when dirty. A constant flow rate valve shall be provided in the piping to the filter. Inlet and outlet pressure gauges shall be provided to monitor filter condition.

2.3 GLYCOL-WATER SYSTEM

Propylene glycol shall be inhibited with 1.75 percent dipotassium phosphate. Do not use automotive anti-freeze because the inhibitors used are not needed and can cause sludge precipitate that interferes with heat transfer.

Provide required amount of glycol to obtain the percent by volume for glycol-water systems as follows and to provide one-half tank reserve supply: 30 percent for chilled water system.

Pot Feeder Make-up Unit: By pass type for chemical treatment, schedule 3.5 mm (10 gauge) heads, 20 mm (3/4-inch) system connections and large neck opening for chemical addition. Feeders shall be 19 Liters (5 gallon) minimum size.

2.4 EQUIPMENT AND MATERIALS IDENTIFICATION

Refer to Section 23 05 11, COMMON WORK RESULTS FOR HVAC and STEAM GENERATION.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Delivery and Storage: Deliver all chemicals in manufacturer's sealed shipping containers. Store in designated space and protect from deleterious exposure and hazardous spills.
- B. Install equipment furnished by the chemical treatment supplier and charge systems according to the manufacturer's instructions and as directed by the Technical Representative.
- C. Refer to Section 23 21 13 HYDRONIC PIPING for chemical treatment piping, installed as follows:
 - 1. Provide a by-pass line around water meters and bleed off piping assembly. Provide ball valves to allow for bypassing, isolation, and servicing of components.
 - 2. Bleed off water piping with bleed off piping assembly shall be piped from pressure side of circulating water piping to a convenient drain. Bleed off connection to main circulating water piping shall be upstream of chemical injection nozzles.
 - 3. Provide piping for the flow assembly piping to the main control panel and accessories.

The inlet piping shall connect to the discharge side of the circulating water pump.

Provide inlet Y-strainer and ball valves to isolate and service main control panel and accessories.
 - 4. Provide piping for corrosion monitor rack per manufacturer's installation instructions. Provide ball valves to isolate and service rack.
 - 5. Provide installation supervision, start-up and operating instruction by manufacturer's technical representative.
- D. Before adding cleaning chemical to the closed system, all air handling coils and fan coil units should be isolated by closing the inlet and outlet valves and opening the bypass valves. This is done to prevent dirt and solids from lodging the coils.
- E. Do not valve in or operate system pumps until after system has been cleaned.
- F. After chemical cleaning is satisfactorily completed, open the inlet and outlet valves to each coil and close the by-pass valves. Also, clean all strainers.

Perform tests and report results in accordance with Section 01 00 00,
GENERAL REQUIREMENTS.

After cleaning is complete, and water PH is acceptable to manufacturer of
water treatment chemical, add manufacturer-recommended amount of
chemicals to systems.

Instruct VA personnel in system maintenance and operation in accordance
with Section 01 00 00, GENERAL REQUIREMENTS.

- - - E N D - - -

THIS PAGE INTENTIONALLY LEFT BLANK

SECTION 23 31 00
HVAC DUCTS AND CASINGS

PART 1 - GENERAL

1.1 DESCRIPTION

Ductwork and accessories for HVAC including the following: 1.

Supply air, return air, outside air and exhaust systems.

Definitions:

SMACNA Standards as used in this specification means the HVAC Duct Construction Standards, Metal and Flexible.

Seal or Sealing: Use of liquid or mastic sealant, with or without compatible tape overlay, or gasketing of flanged joints, to keep air leakage at duct joints, seams and connections to an acceptable minimum.

Duct Pressure Classification: SMACNA HVAC Duct Construction Standards, Metal and Flexible.

1.2 RELATED WORK

Fire Stopping Material: Section 07 84 00, FIRESTOPPING.

Seismic Reinforcing: Section 13 05 41, SEISMIC RESTRAINT REQUIREMENTS FOR NON-STRUCTURAL COMPONENTS.

General Mechanical Requirements: Section 23 05 11, COMMON WORK RESULTS FOR HVAC and STEAM GENERATION.

Noise Level Requirements: Section 23 05 41, NOISE AND VIBRATION CONTROL FOR HVAC PIPING and EQUIPMENT.

Duct Insulation: Section 23 07 11, HVAC, PLUMBING, and BOILER PLANT INSULATION

Plumbing Connections: Section 22 11 00, FACILITY WATER DISTRIBUTION

Air Flow Control Valves and Terminal Units: Section 23 36 00, AIR TERMINAL UNITS.

Air Filters and Filters' Efficiencies: Section 23 40 00, HVAC AIR CLEANING DEVICES.

Duct Mounted Instrumentation: Section 23 09 23, DIRECT-DIGITAL CONTROL SYSTEM FOR HVAC.

Testing and Balancing of Air Flows: Section 23 05 93, TESTING, ADJUSTING, and BALANCING FOR HVAC.

Smoke Detectors: Section 28 31 00, FIRE DETECTION and ALARM.

1.3 QUALITY ASSURANCE

Refer to article, QUALITY ASSURANCE, in Section 23 05 11, COMMON WORK RESULTS FOR HVAC and STEAM GENERATION.

Fire Safety Code: Comply with NFPA 90A.

Duct System Construction and Installation: Referenced SMACNA Standards are the minimum acceptable quality.

Duct Sealing, Air Leakage Criteria, and Air Leakage Tests: Ducts shall be sealed as per duct sealing requirements of SMACNA HVAC Air Duct Leakage Test Manual for duct pressure classes shown on the drawings.

Duct accessories exposed to the air stream, such as dampers of all types (except smoke dampers) and access openings, shall be of the same material as the duct or provide at least the same level of corrosion resistance.

1.4 SUBMITTALS

A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA.

B. Manufacturer's Literature and Data:

1. Rectangular ducts:

Schedules of duct systems, materials and selected SMACNA construction alternatives for joints, sealing, gage and reinforcement.

Duct liner.

Sealants and gaskets.

Access doors.

2. Round and flat oval duct construction details:

Manufacturer's details for duct fittings.

Duct liner.

Sealants and gaskets.

Access sections.

Installation instructions.

3. Volume dampers, back draft dampers.

4. Upper hanger attachments.

5. Fire dampers, fire doors, and smoke dampers with installation instructions.

6. Flexible ducts and clamps, with manufacturer's installation instructions.

7. Flexible connections.

8. Instrument test fittings.

9 Details and design analysis of alternate or optional duct systems.

10 COMMON WORK RESULTS FOR HVAC and STEAM GENERATION.

C. Coordination Drawings: Refer to article, SUBMITTALS, in Section 23 05

1.5 APPLICABLE PUBLICATIONS

- A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.

American Society of Civil Engineers (ASCE):

ASCE7-05 Minimum Design Loads for Buildings and Other Structures

American Society for Testing and Materials (ASTM):

A167-99(2009) Standard Specification for Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip

A653-09 Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy coated (Galvannealed) by the Hot-Dip process

A1011-09a Standard Specification for Steel, Sheet and Strip, Hot rolled, Carbon, structural, High-Strength Low-Alloy, High Strength Low-Alloy with Improved Formability, and Ultra-High Strength

B209-07 Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate

C1071-05e1 Standard Specification for Fibrous Glass Duct Lining Insulation (Thermal and Sound Absorbing Material)

E84-09a Standard Test Method for Surface Burning Characteristics of Building Materials

National Fire Protection Association (NFPA):

90A-09 Standard for the Installation of Air Conditioning and Ventilating Systems

96-08 Standard for Ventilation Control and Fire Protection of Commercial Cooking Operations

Sheet Metal and Air Conditioning Contractors National Association (SMACNA):

2nd Edition - 2005 HVAC Duct Construction Standards, Metal and Flexible

1st Edition - 1985 HVAC Air Duct Leakage Test Manual

6th Edition - 2003 Fibrous Glass Duct Construction Standards

Underwriters Laboratories, Inc. (UL):

181-08 Factory-Made Air Ducts and Air Connectors

555-06 Standard for Fire Dampers

555S-06 Standard for Smoke Dampers

PART 2 - PRODUCTS

2.1 DUCT MATERIALS AND SEALANTS

- A. General: Except for systems specified otherwise, construct ducts, casings, and accessories of galvanized sheet steel, ASTM A653, coating G90; or, aluminum sheet, ASTM B209, alloy 1100, 3003 or 5052.
- B. Specified Corrosion Resistant Systems: Stainless steel sheet, ASTM A167, Class 302 or 304, Condition A (annealed) Finish No. 4 for exposed ducts and Finish No. 2B for concealed duct or ducts located in mechanical rooms.
- C. Joint Sealing: Refer to SMACNA HVAC Duct Construction Standards, paragraph S1.9.

Sealant: Elastomeric compound, gun or brush grade, maximum 25 flame spread and 50 smoke developed (dry state) compounded specifically for sealing ductwork as recommended by the manufacturer. Generally provide liquid sealant, with or without compatible tape, for low clearance slip joints and heavy, permanently elastic, mastic type where clearances are larger. Oil base caulking and glazing compounds are not acceptable because they do not retain elasticity and bond.

Tape: Use only tape specifically designated by the sealant manufacturer and apply only over wet sealant. Pressure sensitive tape shall not be used on bare metal or on dry sealant.

Gaskets in Flanged Joints: Soft neoprene.

- D. Approved factory made joints may be used.

2.2 DUCT CONSTRUCTION AND INSTALLATION

Regardless of the pressure classifications outlined in the SMACNA Standards, fabricate and seal the ductwork in accordance with the following pressure classifications:

Duct Pressure Classification:

- 0 to 50 mm (2 inch)
- > 50 mm to 75 mm (2 inch to 3 inch)
- > 75 mm to 100 mm (3 inch to 4 inch)

Show pressure classifications on the floor plans.

Seal Class: All ductwork shall receive Class A Seal

Round and Flat Oval Ducts: Furnish duct and fittings made by the same manufacturer to insure good fit of slip joints. When submitted and approved in advance, round and flat oval duct, with size converted on the basis of equal pressure drop, may be furnished in lieu of rectangular duct design shown on the drawings.

1. Elbows: Diameters 80 through 200 mm (3 through 8 inches) shall be two sections die stamped, all others shall be gored construction, maximum 18 degree angle, with all seams continuously welded or standing seam. Coat galvanized areas of fittings damaged by welding with corrosion resistant aluminum paint or galvanized repair compound.
2. Provide bell mouth, conical tees or taps, laterals, reducers, and other low loss fittings as shown in SMACNA HVAC Duct Construction Standards.
3. Ribbed Duct Option: Lighter gage round/oval duct and fittings may be furnished provided certified tests indicating that the rigidity and performance is equivalent to SMACNA standard gage ducts are submitted.

Ducts: Manufacturer's published standard gage, G90 coating, spiral lock seam construction with an intermediate standing rib.

Fittings: May be manufacturer's standard as shown in published catalogs, fabricated by spot welding and bonding with neoprene base cement or machine formed seam in lieu of continuous welded seams.

4. Provide flat side reinforcement of oval ducts as recommended by the manufacturer and SMACNA HVAC Duct Construction Standard S3.13. Because of high pressure loss, do not use internal tie-rod reinforcement unless approved by the Resident Engineer.

Casings and Plenums: Construct in accordance with SMACNA HVAC Duct Construction Standards Section 6, including curbs, access doors, pipe penetrations, eliminators and drain pans. Access doors shall be hollow metal, insulated, with latches and door pulls, 500 mm (20 inches) wide by 1200 - 1350 mm (48 - 54 inches) high. Provide view port in the doors where shown. Provide drain for outside air louver plenum. Outside air plenum shall have exterior insulation. Drain piping shall be routed to the nearest floor drain.

Volume Dampers: Single blade or opposed blade, multi-louver type as detailed in SMACNA Standards. Refer to SMACNA Detail Figure 2-12 for Single Blade and Figure 2.13 for Multi-blade Volume Dampers.

Duct Hangers and Supports: Refer to SMACNA Standards Section IV. Avoid use of trapeze hangers for round duct.

2.3 DUCT LINER

- A. Duct sizes shown on drawings for lined duct are clear opening inside lining.

Duct liner is only permitted to be used for return, relief and general exhaust ducts. Duct liner is not permitted for outside air ducts, supply air ducts or any other positive pressure ductwork (provide exterior insulation only).

Rectangular Duct or Casing Liner: ASTM C1071, Type I (flexible), or Type II (board), 25 mm (one inch) minimum thickness, applied with mechanical fasteners and 100 percent coverage of adhesive in conformance with SMACNA, Duct Liner Application Standard.

D. Round and Oval Duct Liner: Factory fabricated double-walled with 25 mm (one inch) thick sound insulation and inner perforated galvanized metal liner. Construction shall comply with flame and smoke rating required by NFPA 90A. Metal liner shall be 1.0 to 0.60 mm (20 to 24 gage) having perforations not exceeding 2.4 mm (3/32 inch) diameter and approximately 22 percent free area. Metal liner for fittings need not be perforated. Assemblies shall be complete with continuous sheet Mylar liner, 2 mil thickness, between the perforated liner and the insulation to prevent erosion of the insulation. Provide liner couplings/spacer for metal liner. At the end of insulated sections, provide insulation end fittings to reduce outer shell to liner size. Provide liner spacing/concentricity leaving airway unobstructed.

2.4 DUCT ACCESS DOORS, PANELS AND SECTIONS

- A. Provide access doors, sized and located for maintenance work, upstream, in the following locations:
- Each duct mounted coil and humidifier.
 - Each fire damper (for link service), smoke damper and automatic control damper.
 - Each duct mounted smoke detector.
- For cleaning operating room supply air duct and kitchen hood exhaust duct, locate access doors at 6 m (20 feet) intervals and at each change in duct direction.
- B. Openings shall be as large as feasible in small ducts, 300 mm by 300 mm (12 inch by 12 inch) minimum where possible. Access sections in insulated ducts shall be double-wall, insulated. Transparent shatterproof covers are preferred for uninsulated ducts.
- For rectangular ducts: Refer to SMACNA HVAC Duct Construction Standards (Figure 2-12).
- For round and flat oval duct: Refer to SMACNA HVAC duct Construction Standards (Figure 2-11).

2.5 FIRE DAMPERS

Galvanized steel, interlocking blade type, UL listing and label, 1-1/2 hour rating, 70 degrees C (160 degrees F) fusible line, 100 percent free opening with no part of the blade stack or damper frame in the air stream.

Fire dampers in wet air exhaust shall be of stainless steel construction, all others may be galvanized steel.

C. Minimum requirements for fire dampers:

The damper frame may be of design and length as to function as the mounting sleeve, thus eliminating the need for a separate sleeve, as allowed by UL 555. Otherwise provide sleeves and mounting angles, minimum 1.9 mm (14 gage), required to provide installation equivalent to the damper manufacturer's UL test installation. Submit manufacturer's installation instructions conforming to UL rating test.

2.6 SMOKE DAMPERS

- A. Maximum air velocity, through free area of open damper, and pressure loss: Low pressure and medium pressure duct (supply, return, exhaust, outside air): 450 m/min (1500 fpm). Maximum static pressure loss: 32 Pa (0.13 inch W.G.).
- B. Maximum air leakage, closed damper: 0.32 cubic meters /min/square meter (4.0 CFM per square foot) at 750 Pa (3 inch W.G.) differential pressure.
- C. Minimum requirements for dampers:

Shall comply with requirements of Table 6-1 of UL 555S, except for the Fire Endurance and Hose Stream Test.

Frame: Galvanized steel channel with side, top and bottom stops or seals.

Blades: Galvanized steel, parallel type preferably, 300 mm (12 inch) maximum width, edges sealed with neoprene, rubber or felt, if required to meet minimum leakage. Airfoil (streamlined) type for minimum noise generation and pressure drop are preferred for duct mounted dampers.

Shafts: Galvanized steel.

Bearings: Nylon, bronze sleeve or ball type.

Hardware: Zinc plated.

Operation: Automatic open/close. No smoke damper that requires manual reset or link replacement after actuation is acceptable. See drawings for required control operation.

- D. Motor operator (actuator): Provide pneumatic or electric as required by the automatic control system, externally mounted on stand-offs to allow complete insulation coverage.

2.7 FLEXIBLE AIR DUCT

- A. General: Factory fabricated, complying with NFPA 90A for connectors not passing through floors of buildings. Flexible ducts shall not penetrate any fire or smoke barrier which is required to have a fire resistance rating of one hour or more. Flexible duct length shall not exceed 1.5 m

(5 feet). Provide insulated acoustical air duct connectors in supply air duct systems and elsewhere as shown.

- B. Flexible ducts shall be listed by Underwriters Laboratories, Inc., complying with UL 181. Ducts larger than 200 mm (8 inches) in diameter shall be Class 1. Ducts 200 mm (8 inches) in diameter and smaller may be Class 1 or Class 2.
- C. Insulated Flexible Air Duct: Factory made including mineral fiber insulation with maximum C factor of 0.25 at 24 degrees C (75 degrees F) mean temperature, encased with a low permeability moisture barrier outer jacket, having a puncture resistance of not less than 50 Beach Units. Acoustic insertion loss shall not be less than 3 dB per 300 mm (foot) of straight duct, at 500 Hz, based on 150 mm (6 inch) duct, of 750 m/min (2500 fpm).
- D. Application Criteria:
 Temperature range: -18 to 93 degrees C (0 to 200 degrees F) internal.
 Maximum working velocity: 1200 m/min (4000 feet per minute).
 Minimum working pressure, inches of water gage: 2500 Pa (10 inches) positive, 500 Pa (2 inches) negative.
- E. Duct Clamps: 100 percent nylon strap, 80 kg (175 pounds) minimum loop tensile strength manufactured for this purpose or stainless steel strap with cadmium plated worm gear tightening device. Apply clamps with sealant and as approved for UL 181, Class 1 installation.

2.8 FLEXIBLE DUCT CONNECTIONS

Where duct connections are made to fans, air terminal units, and air handling units, install a non-combustible flexible connection of 822 g (29 ounce) neoprene coated fiberglass fabric approximately 150 mm (6 inches) wide. For connections exposed to sun and weather provide hypalon coating in lieu of neoprene. Burning characteristics shall conform to NFPA 90A. Securely fasten flexible connections to round ducts with stainless steel or zinc-coated iron draw bands with worm gear fastener. For rectangular connections, crimp fabric to sheet metal and fasten sheet metal to ducts by screws 50 mm (2 inches) on center. Fabric shall not be stressed other than by air pressure. Allow at least 25 mm (one inch) slack to insure that no vibration is transmitted.

2.9 PREFABRICATED ROOF CURBS

Galvanized steel or extruded aluminum 300 mm (12 inches) above finish roof service, continuous welded corner seams, treated wood nailer, 40 mm (1-1/2 inch) thick, 48 kg/cubic meter (3 pound/cubic feet) density rigid mineral fiberboard insulation with metal liner, built-in cant strip

(except for gypsum or tectum decks). For surface insulated roof deck, provide raised cant strip (recessed mounting flange) to start at the upper surface of the insulation. Curbs shall be constructed for pitched roof or ridge mounting as required to keep top of curb level.

2.10 FIRESTOPPING MATERIAL

Refer to Section 07 84 00, FIRESTOPPING.

2.11 DUCT MOUNTED TEMPERATURE SENSOR (AIR)

Refer to Section 23 09 23, DIRECT-DIGITAL CONTROL SYSTEM FOR HVAC.

2.12 INSTRUMENT TEST FITTINGS

Manufactured type with a minimum 50 mm (two inch) length for insulated duct, and a minimum 25 mm (one inch) length for duct not insulated. Test hole shall have a flat gasket for rectangular ducts and a concave gasket for round ducts at the base, and a screw cap to prevent air leakage.

Provide instrument test holes at each duct or casing mounted temperature sensor or transmitter, and at entering and leaving side of each heating coil, cooling coil, and heat recovery unit.

PART 3 - EXECUTION

3.1 INSTALLATION

Comply with provisions of Section 23 05 11, COMMON WORK RESULTS FOR HVAC and STEAM GENERATION, particularly regarding coordination with other trades and work in existing buildings.

Fabricate and install ductwork and accessories in accordance with referenced SMACNA Standards:

Drawings show the general layout of ductwork and accessories but do not show all required fittings and offsets that may be necessary to connect ducts to equipment, boxes, diffusers, grilles, etc., and to coordinate with other trades. Fabricate ductwork based on field measurements. Provide all necessary fittings and offsets at no additional cost to the government. Coordinate with other trades for space available and relative location of HVAC equipment and accessories on ceiling grid. Duct sizes on the drawings are inside dimensions which shall be altered by Contractor to other dimensions with the same air handling characteristics where necessary to avoid interferences and clearance difficulties.

Provide duct transitions, offsets and connections to dampers, coils, and other equipment in accordance with SMACNA Standards, Section II.

Provide streamliner, when an obstruction cannot be avoided and must be taken in by a duct. Repair galvanized areas with galvanizing repair compound.

Provide bolted construction and tie-rod reinforcement in accordance with SMACNA Standards.

Construct casings, eliminators, and pipe penetrations in accordance with SMACNA Standards, Chapter 6. Design casing access doors to swing against air pressure so that pressure helps to maintain a tight seal. Install duct hangers and supports in accordance with SMACNA Standards, Chapter 4.

Install fire dampers, smoke dampers and combination fire/smoke dampers in accordance with the manufacturer's instructions to conform to the installation used for the rating test. Install fire dampers, smoke dampers and combination fire/smoke dampers at locations indicated and where ducts penetrate fire rated and/or smoke rated walls, shafts and where required by the Resident Engineer. Install with required perimeter mounting angles, sleeves, breakaway duct connections, corrosion resistant springs, bearings, bushings and hinges per UL and NFPA. Demonstrate re-setting of fire dampers and operation of smoke dampers to the Resident Engineer.

Seal openings around duct penetrations of floors and fire rated partitions with fire stop material as required by NFPA 90A.

Flexible duct installation: Refer to SMACNA Standards, Chapter 3. Ducts shall be continuous, single pieces not over 1.5 m (5 feet) long (NFPA 90A), as straight and short as feasible, adequately supported. Centerline radius of bends shall be not less than two duct diameters. Make connections with clamps as recommended by SMACNA. Clamp per SMACNA with one clamp on the core duct and one on the insulation jacket. Flexible ducts shall not penetrate floors, or any chase or partition designated as a fire or smoke barrier, including corridor partitions fire rated one hour or two hour. Support ducts SMACNA Standards.

Where diffusers, registers and grilles cannot be installed to avoid seeing inside the duct, paint the inside of the duct with flat black paint to reduce visibility.

Control Damper Installation:

Provide necessary blank-off plates required to install dampers that are smaller than duct size. Provide necessary transitions required to install dampers larger than duct size.

Assemble multiple sections dampers with required interconnecting linkage and extend required number of shafts through duct for external mounting of damper motors.

Provide necessary sheet metal baffle plates to eliminate stratification and provide air volumes specified. Locate baffles by

experimentation, and affix and seal permanently in place, only after stratification problem has been eliminated.

4. Install all damper control/adjustment devices on stand-offs to allow complete coverage of insulation.

Low Pressure Duct Liner: Install in accordance with SMACNA, Duct Liner Application Standard.

Protection and Cleaning: Adequately protect equipment and materials against physical damage. Place equipment in first class operating condition, or return to source of supply for repair or replacement, as determined by Resident Engineer. Protect equipment and ducts during construction against entry of foreign matter to the inside and clean both inside and outside before operation and painting. When new ducts are connected to existing ductwork, clean both new and existing ductwork by mopping and vacuum cleaning inside and outside before operation.

3.2 DUCT LEAKAGE TESTS AND REPAIR

Ductwork leakage testing shall be performed by the Testing and Balancing Contractor directly contracted by the General Contractor and independent of the Sheet Metal Contractor.

Ductwork leakage testing shall be performed for the entire air distribution system (including all supply, return and exhaust ductwork), section by section, including fans, coils and filter sections. In no case shall the leakage testing of ductwork constructed above the 500 Pa (2" WG) duct pressure classification or ductwork located in shafts or other inaccessible areas be eliminated.

Test procedure, apparatus and report shall conform to SMACNA Leakage Test manual. The maximum leakage rate allowed is 4 percent of the design air flow rate.

All ductwork shall be leak tested first before enclosed in a shaft or covered in other inaccessible areas.

All tests shall be performed in the presence of the Resident Engineer and the Test and Balance agency. The Test and Balance agency shall measure and record duct leakage and report to the Resident Engineer and identify leakage source with excessive leakage.

If any portion of the duct system tested fails to meet the permissible leakage level, the Contractor shall rectify sealing of ductwork to bring it into compliance and shall retest it until acceptable leakage is demonstrated to the Resident Engineer.

All tests and necessary repairs shall be completed prior to insulation or concealment of ductwork.

H. Make sure all openings used for testing flow and temperatures by TAB Contractor are sealed properly.

3.3 TESTING, ADJUSTING AND BALANCING (TAB)

Refer to Section 23 05 93, TESTING, ADJUSTING, and BALANCING FOR HVAC. **3.4 OPERATING AND PERFORMANCE TESTS**

Refer to Section 23 05 11, COMMON WORK RESULTS FOR HVAC and STEAM GENERATION

- - - E N D - - -

THIS PAGE INTENTIONALLY LEFT BLANK

SECTION 23 37 00
AIR OUTLETS AND INLETS

PART 1 - GENERAL

1.1 DESCRIPTION

Roof Curbs

Air Outlets and Inlets: Diffusers, Registers, and Grilles.

1.2 RELATED WORK

Seismic Reinforcing: Section 13 05 41, SEISMIC RESTRAINT REQUIREMENTS FOR NON-STRUCTURAL COMPONENTS.

General Mechanical Requirements: Section 23 05 11, COMMON WORK RESULTS FOR HVAC.

Noise Level Requirements: Section 23 05 41, NOISE AND VIBRATION CONTROL FOR HVAC PIPING AND EQUIPMENT.

Testing and Balancing of Air Flows: Section 23 05 93, TESTING, ADJUSTING, AND BALANCING FOR HVAC.

1.3 QUALITY ASSURANCE

Refer to article, QUALITY ASSURANCE, in Section 23 05 11, COMMON WORK RESULTS FOR HVAC.

Fire Safety Code: Comply with NFPA 90A.

1.4 SUBMITTALS

Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA.

Manufacturer's Literature and Data:

1. Diffusers, registers, grilles and accessories.

Coordination Drawings: Refer to article, SUBMITTALS, in Section 23 05 11, COMMON WORK RESULTS FOR HVAC.

1.5 APPLICABLE PUBLICATIONS

The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.

Air Diffusion Council Test Code:

1062 GRD-84 Certification, Rating, and Test Manual 4th Edition

American Society of Civil Engineers (ASCE):

ASCE7-05 Minimum Design Loads for Buildings and Other Structures

American Society for Testing and Materials (ASTM):

A167-99 (2004) Standard Specification for Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet and Strip

B209-07Standard Specification for Aluminum and
Aluminum-Alloy Sheet and Plate

National Fire Protection Association (NFPA):

90A-09 Standard for the Installation of Air
Conditioning and Ventilating Systems

Underwriters Laboratories, Inc. (UL):

181-08 UL Standard for Safety Factory-Made Air Ducts
and Connectors

PART 2 - PRODUCTS

2.1 EQUIPMENT SUPPORTS

Refer to Section 21 05 11, COMMON WORK RESULTS FOR FIRE SUPPRESSION,
Section 22 05 11, COMMON WORK RESULTS FOR PLUMBING, and Section 23 05
11, COMMON WORK RESULTS FOR HVAC.

2.2 AIR OUTLETS AND INLETS

A. Materials:

Steel or aluminum. Provide manufacturer's standard gasket.

Exposed Fastenings: The same material as the respective inlet or
outlet. Fasteners for aluminum may be stainless steel.

Contractor shall review all ceiling drawings and details and provide
all ceiling mounted devices with appropriate dimensions and trim
for the specific locations.

B. Performance Test Data: In accordance with Air Diffusion Council Code
1062GRD. Refer to Section 23 05 41, NOISE AND VIBRATION CONTROL FOR
HVAC PIPING AND EQUIPMENT for NC criteria.

C. Air Supply Outlets:

1. Ceiling Diffusers: Suitable for surface mounting, exposed T-bar or
special tile ceilings, off-white finish, square or round neck
connection as shown on the drawings. Provide plaster frame for
units in plaster ceilings.

Square, louver, fully adjustable pattern: Round neck, surface
mounting unless shown otherwise on the drawings. Provide
equalizing or control grid and volume control damper.

Louver face type: Square or rectangular, removable core for 1, 2,
3, or 4 way directional pattern. Provide equalizing or control
grid and opposed blade damper.

2. Supply Registers: Double deflection type with horizontal face
bars and opposed blade damper with removable key operator.

Margin: Flat, 30 mm (1-1/4 inches) wide.

Bar spacing: 20 mm (3/4 inch) maximum.

- c. Finish: Off white baked enamel for ceiling mounted units.
Wall units shall have a prime coat for field painting, or shall be extruded with manufacturer's standard finish.
- 3. Supply Grilles: Same as registers but without the opposed blade damper.
- D. Return and Exhaust Registers and Grilles: Provide opposed blade damper without removable key operator for registers.
 - 1. Finish: Off-white baked enamel for ceiling mounted units. Wall units shall have a prime coat for field painting, or shall be extruded aluminum with manufacturer's standard aluminum finish.
 - 2. Egg Crate Grilles: Aluminum or Painted Steel 1/2 by 1/2 by 1/2 inch grid providing 90% free area.
Heavy extruded aluminum frame shall have countersunk screw mounting. Unless otherwise indicated, register blades and frame shall have factory applied white finish.
Grille shall be suitable for duct or surface mounting as indicated on drawings. All necessary appurtenances shall be provided to allow for mounting.
- E. Acoustic Transfer Grille: Aluminum, suitable for partition or wall mounting.

2.3 FILTER RETURN/EXHAUST GRILLE

- A. Provide grille with in stream 1-inch deep MERV 4 filter and removable face.
 - 1. Finish: Off-white baked enamel for ceiling mounted units. Wall units shall have a prime coat for field painting, or shall be extruded aluminum with manufacturer's standard aluminum finish. Stainless Steel shall be No. 4 finish.
 - 2. Egg Crate Grilles: Aluminum or Painted Steel 1/2 by 1/2 by 1/2 inch grid providing 90% free area.
Heavy extruded aluminum frame shall have countersunk screw mounting. Unless otherwise indicated, register blades and frame shall have factory applied white finish.
Grille shall be suitable for duct or surface mounting as indicated on drawings. All necessary appurtenances shall be provided to allow for mounting.
 - 3. Steel, Aluminum, or Stainless steel as scheduled.
 - 4. Standard face connected to a mounting frame with space for a throwaway filter. Hold face closed by a locking screw. Provide

retaining clips to hold filter in place. Provide fiberglass throwaway filter.

PART 3 - EXECUTION

3.1 INSTALLATION

Comply with provisions of Section 23 05 11, COMMON WORK RESULTS FOR HVAC, particularly regarding coordination with other trades and work in existing buildings.

Protection and Cleaning: Protect equipment and materials against physical damage. Place equipment in first class operating condition, or return to source of supply for repair or replacement, as determined by COTR. Protect equipment during construction against entry of foreign matter to the inside and clean both inside and outside before operation and painting.

3.2 TESTING, ADJUSTING AND BALANCING (TAB)

Refer to Section 23 05 93, TESTING, ADJUSTING, AND BALANCING FOR HVAC. **3.3 OPERATING AND PERFORMANCE TESTS**

Refer to Section 23 05 11, COMMON WORK RESULTS FOR HVAC.

- - - E N D - - -

SECTION 23 40 00
HVAC AIR CLEANING DEVICES

PART 1 - GENERAL

1.1 DESCRIPTION

Air filters for heating, ventilating and air conditioning.

Definitions: Refer to ASHRAE Standard 52.2 for definitions of face velocity, net effective filtering area, media velocity, initial resistance (pressure drop), MERV (Minimum Efficiency Reporting Value), PSE (Particle Size Efficiency), particle size ranges for each MERV number, dust holding capacity and explanation of electrostatic media based filtration products versus mechanical filtration products. Refer to ASHRAE Standard 52.2 Appendix J for definition of MERV-A.

1.2 RELATED WORK

A. Section 23 05 11, COMMON WORK RESULTS FOR HVAC. General mechanical requirements and items, which are common to more than one section of Division 23.

1.3 QUALITY ASSURANCE

Air Filter Performance Report for Extended Surface Filters:

1. Submit a test report for each Grade of filter being offered. The report shall not be more than three (3) years old and prepared by using test equipment, method and duct section as specified by ASHRAE Standard 52.2 for type filter under test and acceptable to COTR, indicating that filters comply with the requirements of this specification. Filters utilizing partial or complete synthetic media will be tested in compliance with pre-conditioning steps as stated in Appendix J. All testing is to be conducted on filters with a nominal 24 inch by 24 inch face dimension. Test for 150 m/min (500 fpm) will be accepted for lower velocity rated filters provided the test report of an independent testing laboratory complies with all the requirements of this specification.

Filter Warranty for Extended Surface Filters: Guarantee the filters against leakage, blow-outs, and other deficiencies during their normal useful life, up to the time that the filter reaches the final pressure drop. Defective filters shall be replaced at no cost to the Government.

Comply with UL Standard 900 for flame test.

Nameplates: Each filter shall bear a label or name plate indicating manufacturer's name, filter size, rated efficiency.

contaminant load limit is reached as indicated by maximum (final) pressure drop.

Filter Classification: UL listed and approved conforming to UL Standard 900.

HVAC Filter Types

HVAC Filter Types Table 2.2C				
MERV Value ASHRAE 52.2	MERV-A Value ASHRAE 62.2 Appendix J	Application	Particle Size	Thickness /Type
8	8-A	Pre-Filter	3 to 10 Microns	50 mm (2-inch) Throwaway

2.3 MEDIUM EFFICIENCY PLEATED PANEL PRE-FILTERS (2"; MERV 8; UL 900 CLASS 2):

Construction: Air filters shall be medium efficiency ASHRAE pleated panels consisting of cotton and synthetic or 100% virgin synthetic media, self supporting media with required media stabilizers, and beverage board enclosing frame. Filter media shall be lofted to a uniform depth and formed into a uniform radial pleat. The media stabilizers shall be bonded to the downstream side of the media to maintain radial pleats and prevent media oscillation. An enclosing frame of no less than 28-point high wet-strength beverage board shall provide a rigid and durable enclosure. The frame shall be bonded to the media on all sides to prevent air bypass. Integral diagonal support members on the air entering and air exiting side shall be bonded to the apex of each pleat to maintain uniform pleat spacing in varying airflows.

Performance: The filter shall have a Minimum Efficiency Reporting Value of MERV 8 when evaluated under the guidelines of ASHRAE Standard 52.2. It shall also have a MERV-A of 8 when tested per Appendix J of the same standard. The media shall maintain or increase in efficiency over the life of the filter. Pertinent tolerances specified in Section 7.4 of the Air-Conditioning and Refrigeration Institute (ARI) Standard 850-93 shall apply to the performance ratings. All testing is to be conducted on filters with a nominal 24" x 24" face dimension.

Minimum Efficiency Reporting (MERV)	8
Dust Holding Capacity (Grams)	105
Nominal Size (Width x Height x Depth)	24x24x2
Rated Air Flow Capacity (Cubic Feet per Minute)	2,000
Rated Air Flow Rate (Feet per Minute)	500

Final Resistance (Inches w.g.)	1.0
Maximum Recommended Change-Out Resistance (Inches w.g.)	0.66
Rated Initial Resistance (Inches w.g.)	0.33

The filters shall be approved and listed by Underwriters' Laboratories, Inc. as Class 2 when tested according to U. L. Standard 900 and CAN 4-5111.

2.4 INSTRUMENTATION

Magnehelic Differential Pressure Filter Gages: Nominal 100 mm (four inch) diameter, zero to 500 Pa (zero to two inch water gage), Gages shall be flush-mounted in aluminum panel board, complete with static tips, copper or aluminum tubing, and accessory items to provide zero adjustment.

DDC static (differential) air pressure measuring station. Refer to Specification Section 23 09 23 DIRECT DIGITAL CONTROL SYSTEM FOR HVAC Provide one DDC sensor across each extended surface filter. Provide Petcocks for each gauge or sensor.

Provide one common filter gauge for two-stage filter banks with isolation valves to allow differential pressure measurement. 2.5

HVAC EQUIPMENT FACTORY FILTERS

Manufacturer standard filters within fabricated packaged equipment should be specified with the equipment and should adhere to industry standard.

Cleanable filters are not permitted.

Automatic Roll Type filters are not permitted.

2.6 FILTER RETURN GRILLES

Refer to Section 23 37 00 AIR OUTLETS AND INLETS. PART 3 - EXECUTION

3.1 INSTALLATION

Install supports, filters and gages in accordance with manufacturer's instructions.

Label clearly with words "Contaminated Air" on exhaust ducts leading to the HEPA filter housing. 3.2 START-UP AND TEMPORARY USE

Clean and vacuum air handling units and plenums prior to starting air handling systems.

Install or deliver replacement filter units as directed by the COTR.

- - E N D - - -

**SECTION 23 64 00
PACKAGED WATER CHILLERS**

PART 1 - GENERAL

1.1 DESCRIPTION

A. Scroll air-cooled chillers complete with accessories.

1.2 RELATED WORK

Section 00 72 00, GENERAL CONDITIONS.

Section 01 00 00, GENERAL REQUIREMENTS.

Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, and SAMPLES.

Section 13 05 41, SEISMIC RESTRAINT REQUIREMENTS FOR NON-STRUCTURAL COMPONENTS.

Section 23 05 11, COMMON WORK RESULTS FOR HVAC.

Section 23 21 23, HYDRONIC PUMPS.

Section 23 05 41, NOISE and VIBRATION CONTROL FOR HVAC PIPING and EQUIPMENT.

Section 23 21 13, HYDRONIC PIPING.

Section 23 31 00, HVAC DUCTS and CASINGS

Section 23 05 12, GENERAL MOTOR REQUIREMENTS FOR HVAC and STEAM GENERATION EQUIPMENT.

Section 26 29 11, LOW-VOLTAGE MOTOR STARTERS.

1.3 DEFINITION

Engineering Control Center (ECC) or (DDC): The centralized control point for the intelligent control network. The ECC comprises of personal computer and connected devices to form a single workstation.

BACNET: Building Automation Control Network Protocol, ASHRAE Standard 135.

Ethernet: A trademark for a system for exchanging messages between computers on a local area network using coaxial, fiber optic, or twisted-pair cables.

FTT-10: Echelon Transmitter-Free Topology Transceiver.

1.4 QUALITY ASSURANCE

Refer to Paragraph, QUALITY ASSURANCE, in Section 23 05 11, COMMON WORK RESULTS FOR HVAC and STEAM GENERATION, and comply with the following.

Refer to PART 3 herein after and Section 01 00 00, GENERAL REQUIREMENTS for test performance.

Comply with AHRI requirements for testing and certification of the chillers.

Refer to paragraph, WARRANTY, Section 00 72 00, GENERAL CONDITIONS, except as noted below:

1. Provide an unconditional 5-year motor, and compressor warranty to include materials, parts and labor.

Refer to OSHA 29 CFR 1910.95(a) and (b) for Occupational Noise Exposure Standard

Refer to ASHRAE Standard 15, Safety Standard for Refrigeration System, for refrigerant vapor detectors and monitor.

1.5 APPLICABLE PUBLICATIONS

The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.

Air Conditioning, Heating and Refrigeration Institute (AHRI):

370-01 Sound Rating of Large Outdoor Refrigerating and Air-Conditioning Equipment

495-1999 (R2002)Refrigerant Liquid Receivers

550/590-03Standard for Water Chilling Packages Using the Vapor Compression Cycle

575-94 Methods for Measuring Machinery Sound within Equipment Space

American Society of Heating, Refrigerating, and Air-Conditioning Engineers (ASHRAE):

ANSI/ASHRAE-15-2007 ... Safety Standard for Mechanical Refrigeration Systems

GDL 3-1996 Guidelines for Reducing Emission of Halogenated Refrigerants in Refrigeration and Air-Conditioning Equipment and Systems

American Society of Mechanical Engineers (ASME):

2007 ASME Boiler and Pressure Vessel Code, Section VIII, "Pressure Vessels - Division 1"

American Society of Testing Materials (ASTM):

C 534/ C 534M-2008 Preformed, Flexible Elastomeric Cellular Thermal Insulation in Sheet and Tubular Form

C 612-04 Mineral-fiber Block and Board Thermal Insulation

National Electrical Manufacturing Association (NEMA):

250-2008 Enclosures for Electrical Equipment (1000 Volts Maximum)

National Fire Protection Association (NFPA):

70-2008National Electrical Code

Underwriters Laboratories, Inc. (UL):

1995-2005 Heating and Cooling Equipment

1.6 SUBMITTALS

- A. Submit in accordance with Specification Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, and SAMPLES.
- B. Manufacturer's Literature and Data.
 - 1. Scroll water chillers, including motor starters, control panels, and vibration isolators, and remote condenser data shall include the following:
 - Rated capacity.
 - Pressure drop.
 - Efficiency at full load and part load WITHOUT applying any tolerance indicated in the AHRI 550/590/Standard.
 - Refrigerant
 - Fan performance.
 - Accessories.
 - Installation instructions.
 - Start up procedures.
 - Wiring diagrams, including factory-installed and field-installed wiring.
 - Sound/Noise data report. Manufacturer shall provide sound ratings. Noise warning labels shall be posted on equipment.
 - Refrigerant vapor detectors and monitors.
- C. Maintenance and operating manuals for each piece of equipment in accordance with Section 01 00 00, GENERAL REQUIREMENTS.
- D. Run test report for all chillers.
- E. Product Certificate: Signed by chiller manufacturer certifying that chillers furnished comply with AHRI requirements. The test report shall include calibrated curves, calibration records, and data sheets for the instrumentation used in factory tests.

PART 2 - PRODUCTS

2.1 ROTARY-SCREW AND SCROLL AIR-COOLED WATER CHILLERS

- A. General: Factory-assembled and-tested rotary-screw or scroll water chillers, complete with evaporator, compressors, motor, starters, integral condenser, and controls mounted on a welded steel base. The chiller unit shall consist of two compressors minimum, but not more than eight, mounted on a single welded steel base. Where compressors are paralleled, not more than two shall be so connected and not less than two independent refrigerant circuits shall be provided. Chiller shall be capable of operating one of the following refrigerants: HCFC-134a or HCFC-410a.

Performance: Provide the capacity as shown on the drawings. Part load and full load efficiency ratings of the chiller shall not exceed those shown on the drawings.

Capacity of a single air-cooled chiller shall not exceed 250 Tons (Standard AHRI Conditions).

Applicable Standard: Chillers shall be rated and certified according to AHRI 550/590, and shall be stamped in compliance with AHRI certification.

Acoustics: Sound pressure levels shall not exceed the following specified levels. The manufacturer shall provide sound treatment if required to comply with the specified maximum levels. Testing shall be in accordance with AHRI requirements.

OCTAVE BAND	Overall
63 125 250 500 1000 2000 4000 8000	<u>dB(A)</u>

Compressor (Scroll Type): Three dimensional, positive-displacement, hermetically sealed design, with suction and discharge valves, crankcase oil heater and suction strainer. Compressor shall be mounted on vibration isolators. Rotating parts shall be factory balanced. Lubrication system shall consist of reversible, positive displacement pump, strainer, oil level sight glass, and oil charging valve. Capacity control shall be by on-off compressor cycling of single and multiple compressors and hot gas bypass.

Refrigerants Circuit: Each circuit shall contain include an expansion valve, refrigerant charging connections, hot-gas muffler, compressor suction and discharge shutoff valves, replaceable-core filter drier, sight glass with moisture indicator, liquid-line solenoid valve and insulated suction line.

Refrigerant and Oil: Sufficient volume of dehydrated refrigerant and lubricating oil shall be provided to permit maximum unit capacity operation before and during tests. Replace refrigerant charge lost during the warranty period, due to equipment failure, without cost to the Government.

Condenser:

Air-cooled integral condenser as shown on the drawings and specified hereinafter.

Integral Condenser: Condenser coils shall be extended surface fin and tube type, seamless copper tubes with aluminum fins. For

corrosion protection, see Paragraph 2.7 below. Condenser coils shall be factory air tested at 3105 kPa (450 psig). Condenser fans shall be propeller type, directly connected to motor shaft. Fans shall be statically and dynamically balanced, with wire safety guards. Condenser fan motors with permanently lubricated ball bearings and three-phase thermal overload protection. Unit shall start -18°C (0°F) with external damper assemblies. Units shall have grilles factory mounted to prevent damage to coil surfaces.

Evaporator: Shell and tube design with seamless copper tubes roller expanded into tube sheets. Designed, tested, and stamped in accordance with applicable portions of ASME Boiler and Pressure Vessel Code, Section VIII, for working pressure produced by the water system, but not less than 1035 kPa (15 psig). Refrigerant side working pressure shall comply with ASHRAE Standard 15. Shell shall be constructed of carbon steel. For the waterside of liquid cooler the performance shall be based on a water velocity not less than 1 m/s (3 fps) with a maximum water velocity of 3 m/s (10 fps) and a fouling factor 0.0000176 m^2 degrees C (0.0001 hr. sq. ft.) degrees F/Btu. Evaporator for packaged air-cooled chiller units designed for outdoor installation shall be protected against freeze-up in ambient temperature down to -30 degrees C (-20 degrees F) by a resistance heater cable under insulation with thermostat set to operate below 3 degrees C (37 degrees F) ambient.

Insulation: Evaporator, suction piping, compressor, and all other parts subject to condensation shall be insulated with 20 mm (0.75 inch) minimum thickness of flexible-elastomeric thermal insulation, complying with ASTM C534.

Refrigerant Receiver: Provide a liquid receiver for chiller units when system refrigerant charge exceeds 80 percent of condenser refrigerant volume. Liquid receivers shall be horizontal-type, designed, fitted, and rated in conformance with AHRI 495. Receiver shall be constructed and tested in conformance with Section VIII D1 of the ASME Boiler and Pressure Vessel Code. Each receiver shall have a storage capacity not less than 20 percent in excess of that required for fully charged system. Each receiver shall be equipped with inlet, outlet drop pipes, drain plug, purging valve, and relief devices as required by ASHRAE Standard 15.

Controls: Chiller shall be furnished with unit mounted, stand-alone, microprocessor-based controls in NEMA 3R enclosure, hinged and lockable, factory wired with a single point power connection and separate control

circuit. The control panel provide chiller operation, including monitoring of sensors and actuators, and shall be furnished with light emitting diodes or liquid-crystal display keypad. BACnet integration card with BACnet/IP communication capability.

1. Following shall display as a minimum on the panel:

- Date and time.
- Outdoor air temperature.
- Operating and alarm status.
- Entering and leaving water temperature-chilled water.
- Operating set points-temperature and pressure.
- Refrigerant temperature and pressure.
- Operating hours.
- Number of starts.
- Current limit set point.
- Maximum motor amperage (percent).

2. Control Functions:

- Manual or automatic startup and shutdown time schedule.
- Entering and leaving chilled water temperature and control set points.
- Automatic lead-lag switch.

3. Safety Functions: Following conditions shall shut down the chiller and require manual reset to start:

- Loss of chilled water flow.
- Low chilled water temperature.
- Compressor motor current-overload protection.
- Freeze protection (for air-cooled chillers).
- Starter fault.
- High or low oil pressure.
- Recycling pumpdown.

The chiller control panel shall provide leaving chilled water temperature reset based on return water temperature signal from Energy Control Center (ECC).

Chiller control panel shall reside on the BACnet interworking using ARCNET or MS/TP physical data link layer protocol for communication with building automation control system.

Auxiliary hydronic system and the chiller(s) shall be interlocked to provide time delay and start sequencing as indicated on control drawings.

Motor: Refer to Section 23 05 11, COMMON WORK RESULTS FOR HVAC. Compressor motor furnished with the chiller shall be in accordance with

the chiller manufacturer and the electrical specification Section 23 05 12, GENERAL MOTOR REQUIREMENTS FOR HVAC and STEAM GENERATION EQUIPMENT. Starting torque of motors shall be suitable for driven machines.

- R. Motor Starter: Refer to Section 23 05 11, COMMON WORK RESULTS FOR HVAC. Provide a starter in NEMA I enclosure, designed for floor or unit mounted chiller using multiple compressors, with the lead compressor starting at its minimum capacity may be provided with across-the-line starter. See Section 26 29 11, LOW-VOLTAGE MOTOR STARTERS for additional requirements.

2.2 CORROSION PROTECTION

- A. Exposed Outdoor Cabinet: Casing Surfaces (Exterior and Interior): All exposed and accessible metal surfaces shall be protected with a water-reducible acrylic with stainless steel pigment spray-applied over the manufacturer's standard finish. The spray coating thickness shall be 24 mils and provide minimum salt-spray resistance of 1,000 hours (ASTM B117) AND 500 hours UV resistance (ASTM D4587)

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine roughing-in for concrete equipment bases, anchor-bolt sizes and locations, piping and electrical to verify actual locations and sizes before chiller installation and other conditions that might affect chiller performance, maintenance, and operation. Equipment locations shown on drawings are approximate. Determine exact locations before proceeding with installation.

3.2 EQUIPMENT INSTALLATION

- A. Install chiller on concrete base with isolation pads or vibration isolators.

Concrete base is specified in Section 03 30 00, CAST-IN-PLACE
CONCRETE

Vibration isolator types and installation requirements are specified in Section 23 05 41, NOISE and VIBRATION CONTROL FOR HVAC PIPING and EQUIPMENT

Anchor chiller to concrete base according to manufacturer's written instructions and for seismic restraint on vibration isolators.

Charge the chiller with refrigerant, if not factory charged.

Install accessories and any other equipment furnished loose by the manufacturer, including remote starter, remote control panel, and remote flow switches, according to the manufacturer written instructions and electrical requirements.

6. Chillers shall be installed in a manner as to provide easy access for tube pull and removal of compressor and motors etc.

Install thermometers and gages as recommended by the manufacturer and/or as shown on drawings.

Piping Connections:

Make piping connections to the chiller for chilled water and other connections as necessary for proper operation and maintenance of the equipment.

Make equipment connections with flanges and couplings for easy removal and replacement of equipment from the equipment room. 3.3

STARTUP AND TESTING

- A. Engage manufacturer's factory-trained representative to perform startup and testing service.
- B. Inspect, equipment installation, including field-assembled components, and piping and electrical connections.
- C. After complete installation startup checks, according to the manufacturers written instructions, do the following to demonstrate to the VA that the equipment operate and perform as intended.
- Check refrigerant charge is sufficient and chiller has been tested for refrigerant leak.
- Check bearing lubrication and oil levels.
- Verify proper motor rotation.
- Verify pumps associated with chillers are installed and operational.
- Verify thermometers and gages are installed.
- Verify purge system, if installed, is functional and relief piping is routed outdoor.
- Operate chiller for run-in-period in accordance with the manufacturer's instruction and observe its performance.
- Check and record refrigerant pressure, water flow, water temperature, and power consumption of the chiller.
- Test and adjust all controls and safeties. Replace or correct all malfunctioning controls, safeties and equipment as soon as possible to avoid any delay in the use of the equipment.
- Prepare a written report outlining the results of tests and inspections, and submit it to the VA.
- D. Engage manufacturer's certified factory trained representative to provide training for 8 hours for the VA maintenance and operational personnel to adjust, operate and maintain equipment, including self-contained breathing apparatus.

- - - E N D - - -

SECTION 23 72 00
AIR-TO-AIR ENERGY RECOVERY EQUIPMENT

PART 1 - GENERAL

1.1 DESCRIPTION

This Section specifies air-to-air plate heat exchangers.

1.2 RELATED WORK

Section 01 00 00, GENERAL REQUIREMENTS: Requirements for pre-test of equipment.

Section 13 05 41, SEISMIC RESTRAINT REQUIREMENTS FOR NON-STRUCTURAL COMPONENTS: Seismic requirements for non-structural equipment.

Section 23 05 11, COMMON WORK RESULTS FOR HVAC: General mechanical requirements and items, which are common to more than one section of Division 23.

Section 23 21 23, HYDRONIC PUMPS: Requirements for pumping equipment.

Section 23 07 11, HVAC and BOILER PLANT INSULATION: Requirements for piping insulation.

Section 23 21 13, HYDRONIC PIPING: Requirements for piping for expansion tanks.

Section 23 82 16, AIR COILS: Requirements for run-around system coils.

Section 23 31 00, HVAC DUCTS and CASINGS: Requirements for sheet metal ducts and fittings.

Section 23 40 00, HVAC AIR CLEANING DEVICES: Requirements for filters used before heat recovery coils.

Section 23 09 23, DIRECT-DIGITAL CONTROL SYSTEM FOR HVAC: Requirements for controls and instrumentation.

Section 23 05 93, TESTING, ADJUSTING and BALANCING FOR HVAC: Requirements for testing, adjusting and balancing of HVAC system. 1.3 QUALITY ASSURANCE

Refer to paragraph, GUARANTEE in specification Section 00 72 00, GENERAL CONDITIONS.

Refer to specification Section 01 00 00, GENERAL REQUIREMENTS for performance tests and instructions to VA personnel.

Refer to paragraph QUALITY ASSURANCE in specification Section 23 05 11, COMMON WORK RESULTS FOR HVAC.

Performance Criteria: Heat recovery equipment shall be provided by a manufacturer who has been manufacturing such equipment and the equipment has a good track record for at least 3 years.

Performance Test: In accordance with PART 3.

1.4 SUBMITTALS

Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA. Manufacturer's Literature and Data:

1. Plate Heat Exchanger

Certificate: Submit, simultaneously with shop drawings, an evidence of satisfactory service of the equipment on three similar installations.

Submit type, size, arrangement and performance details. Present application ratings in the form of tables, charts or curves.

Provide installation, operating and maintenance instructions, in accordance with Article, INSTRUCTIONS, in Section 01 00 00, GENERAL REQUIREMENTS.

Completed System Readiness Checklists provided by the Commissioning Agent and completed by the contractor, signed by a qualified technician and dated on the date of completion, in accordance with the requirements of Section 23 08 00 COMMISSIONING OF HVAC SYSTEMS.

1.5 APPLICABLE PUBLICATIONS

The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.

Air Conditioning, Heating, and Refrigeration Institute (AHRI)

AHRI 1060-2005 Performance Rating of Air-to-Air Heat Exchangers
for Energy Recovery Ventilation Equipment

American Society of Heating, Refrigeration and Air Conditioning

Engineers (ASHRAE):

15-10 Safety Standard for Refrigeration Systems (ANSI)

52.1-92 Gravimetric and Dust-Spot Procedures for Testing
Air-Cleaning Devices Used in General Ventilation
for Removing Particulate Matter

52.2-07 Method of Testing General Ventilation Air-
Cleaning Devices for Removal Efficiency by
Particle Size

84-08 Method of Testing Air-to-Air Heat/Energy
Exchangers

American Society for Testing and materials (ASTM)

D635-10 Standard Test Method for Rate of Burning and/or
Extent and Time of Burning of Plastics in a
Horizontal Position

E84-10 Standard Test Method for Surface Burning
Characteristics of Building Materials

American Society of Civil Engineers (ASCE)

ASCE 7-10 Minimum Design Loads for Buildings and Other
Structures

Underwriters Laboratories, Inc (UL)

1812-2009Standard for Ducted Heat Recovery Ventilators

1815-2009 Standard for Nonducted Heat Recovery Ventilators

PART 2 - PRODUCTS

2.1 FLAT PLATE HEAT EXCHANGER

Provide cross flow flat plate heat exchanger with performance as scheduled. Counter flow heat exchangers are unacceptable due to high pressure drop and fouling concerns.

Heat exchanger plates shall be completely smooth with no dimples or corrugations for contaminants to adhere to.

Maximum operating differential pressure of no less than 10" wc at 70°F.

Maximum operating temperature no less than 400°F.

Heat exchanger must have aluminum framing (steel framing not acceptable) and minimum 0.008" thick 99.5% pure aluminum plates.

Entire heat transfer surface shall be visible for inspection and cleaning without disassembling the heat exchanger.

Provide drain pans under entire heat exchanger. Terminate drain pan connections through the side of the unit. Drain lines must be properly trapped and freeze protected by the installing contractor.

2.2 DAMPERS

A. Motorized dampers shall be low leakage type with aluminum construction, airfoil blades, vinyl edge seals, metal jamb seals, and synthetic bearings. Gravity dampers shall have aluminum frame, aluminum blades, extruded vinyl edge seals, and synthetic bearings.

B. The following dampers shall be provided at a minimum (additional dampers may be required, please consult the sequence of operation to determine what is needed):

Outside air shut-off damper, 2-position actuator.

Outside air heat exchanger face damper, modulating actuator.

Outside air heat exchanger bypass damper, modulating actuator.

Exhaust air shut-off damper, 2-position actuator.

C. A controller shall be provided with the damper to provide a 0-10VDC feedback for airflow, temperature, and position.

2.3 FILTERS

Outside air filter: Provide 2" MERV 8 filter bank at the outside air inlet of the heat exchanger. Mount in a galvanized steel side access slide rack and size for 500 fpm maximum face velocity.

Return air filter: Provide 2" MERV 8 filter bank at the return air inlet of the heat exchanger. Mount in a galvanized steel side access slide rack and size for 500 fpm maximum face velocity.

Filter Pressure Monitoring: Magnahelic pressure gauges shall be provided across all filter racks. Filter differential pressure switches shall be provided across all filter racks.

2.4 DDC SYSTEM

A. Manufacturer must provide a stand-alone programmable digital control system for complete temperature control of the delivered air. The manufacturer will provide a standard sequence of operation for the type of equipment provided per this specification. The controller will be programmed to control discharge temperature. The sequence of operation will include the following:

Temperature control for all heating & cooling devices.

Economizer control for "free cooling".

Defrost control for all energy recovery devices.

B. The controller will communicate with the BAS through a Bacnet IP interface card provided by the equipment manufacturer. Only the points necessary to control the equipment will be provided unless a detailed points list is provided elsewhere on the plan drawings.

PART 3 - EXECUTION

3.1 INSTALLATION

Follow the equipment manufacturer's instructions for handling and installation, and setting up of ductwork for makeup and exhaust air steamers for maximum efficiency.

Seal ductwork tightly to avoid air leakage.

Install units with adequate spacing and access for cleaning and maintenance of heat recovery coils as well as filters.

Brace heat recovery equipment installed in projects in the Seismic area according to specification Section 13 05 41, SEISMIC RESTRAINT REQUIREMENTS FOR NON-STRUCTURAL COMPONENTS.

3.2 FIELD QUALITY CONTROL

- A. Operational Test: Perform tests as per manufacturer's written instructions for proper and safe operation of the heat recovery system. After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
Adjust seals and purge.
Test and adjust controls and safeties.
- B. Replace damaged and malfunctioning controls and equipment.
- C. Set initial temperature and humidity set points. Set field-adjustable switches and circuit-breaker trip ranges as indicated.
- D. Prepare test and inspection reports to the Senior COTR in accordance with specification Section 01 00 00, GENERAL REQUIREMENTS.

3.3 INSTRUCTIONS

Provide services of manufacturer's technical representative for four hours to instruct VA personnel in operation and maintenance of heat recovery equipment.

3.4 STARTUP AND TESTING

- A. The Commissioning Agent will observe startup and contractor testing of selected equipment. Coordinate the startup and contractor testing schedules with the COTR and Commissioning Agent. Provide a minimum of 7 days prior notice.

3.5 DEMONSTRATION AND TRAINING

- A. Provide services of manufacturer's technical representative for four hours to instruct VA personnel in operation and maintenance of units.

- - - E N D - - -

THIS PAGE INTENTIONALLY LEFT BLANK

SECTION 23 82 00
CONVECTION HEATING AND COOLING UNITS

PART 1 - GENERAL

1.1 DESCRIPTION

Fan-coil units and unit heaters

1.2 RELATED WORK

Section 13 05 41, SEISMIC RESTRAINT REQUIREMENTS FOR NON-STRUCTURAL COMPONENTS: Seismic restraints for equipment.

Section 23 05 11, COMMON WORK RESULTS FOR HVAC: General mechanical requirements and items, which are common to more than one section of Division 23.

Section 23 05 41, NOISE and VIBRATION CONTROL FOR HVAC PIPING and EQUIPMENT: Noise requirements.

Section 23 21 13, HYDRONIC PIPING: Heating hot water and chilled water piping.

Section 23 31 00, HVAC DUCTS and CASINGS: Ducts and flexible connectors.

Section 23 09 23, DIRECT-DIGITAL CONTROL SYSTEM FOR HVAC: Valve operators.

Section 23 05 93, TESTING, ADJUSTING, and BALANCING FOR HVAC: Flow rates adjusting and balancing.

Section 23 82 16, AIR COILS: Additional coil requirements.

1.3 QUALITY ASSURANCE

Refer to Paragraph, QUALITY ASSURANCE, in Section 23 05 11, COMMON WORK RESULTS FOR HVAC.

1.4 SUBMITTALS

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA.
- B. Manufacturer's Literature and Data:
 - Fan-Coil units.
 - Unit heaters.
- C. Certificates:
 - Compliance with paragraph, QUALITY ASSURANCE.
 - Compliance with specified standards.
- D. Operation and Maintenance Manuals: Submit in accordance with paragraph, INSTRUCTIONS, in Section 01 00 00, GENERAL REQUIREMENTS.

1.5 APPLICABLE PUBLICATIONS

The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.

American National Standards Institute / Air Conditioning, Heating and Refrigeration Institute (ANSI/AHRI):

440-08 Performance Rating of Room Fan Coils

National Fire Protection Association (NFPA):

90A-09 Standard for the Installation of Air Conditioning and Ventilating Systems

70-11 National Electrical Code

Underwriters Laboratories, Inc. (UL):

181-08 Standard for Factory-Made Air Ducts and Air Connectors

1995-05 Heating and Cooling Equipment

1.6 GUARANTY

In accordance with FAR clause 52.246-21

PART 2 - PRODUCTS

2.1 ROOM FAN-COIL UNITS

Capacity Certification: AHRI 440.

Safety Compliance: NEC compliant and UL listed.

Noise Levels: Operating at full cooling capacity, sound power level shall not exceed by more than 5 dB the numerical value of sound pressure levels associated with noise criteria specified in Section 23 05 51, NOISE AND VIBRATION CONTROL FOR HVAC PIPING AND EQUIPMENT. Select units at intermediate speed, for compliance with the noise criteria.

Chassis: Galvanized steel, acoustically and thermally insulated to attenuate noise and prevent condensation.

Cabinet: Minimum 1.3 mm (18 gage) steel reinforced and braced. Arrange components and provide adequate space for installation of piping package and control valves.

1. Horizontal Unit: Provide Concealed type as shown. Provide supports and vibration isolators for horizontal units as recommended by the manufacturer.

a. Concealed Units: Provide furred-in type with return plenum and inlet duct collar and outlet duct collar.

Fans: Centrifugal, forward curved, double width type wheels, galvanized steel or polyester resin construction, statically and dynamically balanced, direct driven.

1. Motors: Premium efficiency, 3-speed permanent split capacitor type with integral thermal overload protection, for operation at not more than 1200 RPM.
2. Provide a fan speed selector switch, with off, low, medium, and high positions. Switch shall have a set of auxiliary contacts which are open when the switch is in the "off" position and closed when the switch in any of the other positions. On vertical units, mount switch in a junction box in the cabinet of each unit. On ceiling-suspended horizontal and concealed units, switch shall be wall mounted.

Cooling and Heating Coils:

1. Hydronic (two separate coils for cooling and heating): Copper tubes, 10 mm (three-eighths inch) minimum inside diameter, not less than 4.3 mm (0.017 inch) thick with copper or aluminum fins. Coils shall be pressure tested for bursting and strength in accordance with Underwriters Laboratories, Inc., requirements for pressure tested coils, and shall be designed to provide adequate heat transfer capacity. Provide manual air vent at high point of each coil and drain at each low point.

Piping Package: Factory furnished with unit by the manufacturer or field-installed by the contractor to fit control valves provided by the controls supplier. Submit manufacturer's detailed drawings of the piping in the end compartments for approval prior to fabrication of the piping packages. Provide ball stop valves on the supply and return pipes and balancing fittings on the return pipes.

Drain pans: Furnish galvanized steel with solderless drain connections and molded polystyrene foam insulating liner:

1. Auxiliary drain pan: Located under control valve and piping within the unit enclosure to prevent dripping.

Air Filter: Manufacturer's standard throwaway type, not less than 25 mm (1 inch) thick, MERV 7, supported to be concealed from sight and be tight fitting to prevent air by-pass. Filters shall have slide out frames and be easily replaced without removing enclosure or any part thereof.

- K. Control valves and remote wall mounted space thermostats, where shown or specified are to be field installed. Provide two-way modulating control valves unless shown or specified otherwise.

2.2 UNIT HEATERS

- A. General: Horizontal or vertical discharge type for hot water heating medium, as indicated.
- B. Casing: Steel sheet, phosphatized to resist rust and finished in baked enamel. Provide hanger supports.
- C. Fan: Propeller type, direct driven by manufacturer's standard electric motor. Provide resilient mounting. Provide fan guard for horizontal discharge units.
- D. Discharge Air Control:
 - Horizontal discharge: Horizontal, adjustable louvers.
 - Vertical discharge: Radial louver diffuser.
- E. Hot Water Coil: Aluminum fins bonded to seamless copper tubing by mechanical expansion of the tubing, designed for 517 kPa (75 psig) steam working pressure.
- F. Controls: Provide field installed remote wall mounted line voltage electric space thermostats where shown or specified to control the unit fan. Provide an aquastat on hot water units to prevent fan operation when the heating system is off.

2.3 WALL-MOUNTED UNIT HEATER

- A. General: Electric heat, fan driven, thermostatic control, UL listed.
- B. Enclosure:
 - Wall box: Not less than 1.3 mm (18 gage) steel, recessed type.
 - Ribbed 1.6 mm (16 gage) steel front cover.
 - Closely spaced discharge louvers.
 - Concealed screws for locking trim frame to front cover.
 - Finished in baked enamel of manufacturer's standard color with satin finish anodized aluminum trim frame.
- C. Heating Elements: Steel sheath enclosed finned-tube type.
- D. Integral Controls:
 - 1. Two-pole terminal block.
 - 2. Built-in fan delay switch.
 - 3. Automatic reset line voltage internal thermal overheats protection.

4. Built-in thermostat comfort control with adjustment range between -1 to 32 degree C (30-90 degrees F), and manually set "No Heat" position; tamper resistant adjustment by inserting screwdriver through front cover louvers.

PART 3 - EXECUTION

3.1 INSTALLATION

Work shall be installed as shown and according to the manufacturer's diagrams and recommendations.

Handle and install units in accordance with manufacturer's written instructions.

Support units rigidly so they remain stationary at all times.

Cross-bracing or other means of stiffening shall be provided as necessary. Method of support shall be such that distortion and malfunction of units cannot occur.

3.2 OPERATIONAL TEST

Refer to Section 23 05 11, COMMON WORK RESULTS FOR HVAC.

3.3 STARTUP AND TESTING

- A. The COTR will observe startup and contractor testing of selected equipment. Coordinate the startup and contractor testing schedules with the COTR and Commissioning Agent. Provide a minimum of 7 days prior notice.

3.4 DEMONSTRATION AND TRAINING

- A. Provide services of manufacturer's technical representative for four hours to instruct VA personnel in operation and maintenance of units.

- - - E N D - - -

THIS PAGE INTENTIONALLY LEFT BLANK

SECTION 23 82 16
AIR COILS

PART 1 - GENERAL

1.1 DESCRIPTION

Heating and cooling coils for air handling unit and duct applications

1.2 RELATED WORK

Section 23 05 11, COMMON WORK RESULTS FOR HVAC.

Section 23 31 00, HVAC DUCTS AND CASINGS

Section 23 36 00, AIR TERMINAL UNITS: Reheat coils for VAV/CV terminals.

Section 23 82 00, CONVECTION HEATING AND COOLING UNITS

1.3 QUALITY ASSURANCE

Refer to paragraph, QUALITY ASSURANCE, Section 23 05 11, COMMON WORK RESULTS FOR HVAC.

Unless specifically exempted by these specifications, heating and cooling coils shall be tested, rated, and certified in accordance with AHRI Standard 410 and shall bear the AHRI certification label.

1.4 SUBMITTALS

Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA. Manufacturer's Literature and Data for Heating and Cooling Coils: Submit type, size, arrangements and performance details. Present application ratings in the form of tables, charts or curves.

Provide installation, operating and maintenance instructions.

Certification Compliance: Evidence of listing in current ARI Directory of Certified Applied Air Conditioning Products.

Coils may be submitted with Section 23 36 00, AIR TERMINAL UNITS.

1.5 APPLICABLE PUBLICATIONS

The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.

Air Conditioning and Refrigeration Institute (AHRI):

Directory of Certified Applied Air Conditioning Products

AHRI 410-01 Forced-Circulation Air-Cooling and Air-Heating Coils

American Society for Testing and Materials (ASTM):

B75/75M-02 Standard Specifications for Seamless Copper Tube

National Fire Protection Association (NFPA):

70-11 National Electric Code

National Electric Manufacturers Association (NEMA):

250-11Enclosures for Electrical Equipment (1,000 Volts
Maximum)

PART 2 - PRODUCTS

2.1 HEATING AND COOLING COILS

Conform to ASTM B75 and AHRI 410.

Tubes: Minimum 16 mm (0.625 inch) tube diameter; Seamless copper tubing.

Fins: 0.1397 mm (0.0055 inch) aluminum or 0.1143 mm (0.0045 inch) copper mechanically bonded or soldered or helically wound around tubing.

Headers: Copper, welded steel or cast iron. Provide seamless copper tubing or resistance welded steel tube for volatile refrigerant coils.

"U" Bends, Where Used: Machine die-formed, silver brazed to tube ends.

Coil Casing: 1.6 mm (16 gage) galvanized steel with tube supports at 1200 mm (48 inch) maximum spacing. Construct casing to eliminate air bypass and moisture carry-over. Provide duct connection flanges.

Pressures kPa (PSIG):

Pressure	Water Coil
Test	2070 (300)
Working	1380 (200)

Protection: Unless protected by the coil casing, provide cardboard, plywood, or plastic material at the factory to protect tube and finned surfaces during shipping and construction activities.

Vents and Drain: Coils that are not vented or drainable by the piping system shall have capped vent/drain connections extended through coil casing.

Dampers: Interlocking opposed blades to completely isolate coil from air flow when unit is in bypass position; 1.6 mm (16 gage) steel, coated with factory applied corrosion resistant baked enamel finish. Provide damper linkage and electric operators. Damper operators shall be of same manufacturer as controls furnished under Section 23 09 23, DIRECT-DIGITAL CONTROL SYSTEM FOR HVAC.

2.2 REHEAT COILS, DUCT MOUNTED

The coils shall be continuous circuit booster type for steam or hot water as shown on drawings. Use the same coil material as listed in Paragraphs 2.1.

2.3 WATER COILS, INCLUDING GLYCOL-WATER

A. Use the same coil material as listed in Paragraphs 2.1.

Drainable Type (Self Draining, Self Venting); Manufacturer standard:

1. Cooling, all types.
2. Heating or preheat.

Cleanable Tube Type; manufacturer standard:

1. Well water applications.

PART 3 - EXECUTION

3.1 INSTALLATION

Follow coil manufacturer's instructions for handling, cleaning, installation and piping connections.

Comb fins, if damaged. Eliminate air bypass or leakage at coil sections.

3.2 STARTUP AND TESTING

- A. The Project Manager and COTR will observe startup and contractor testing of selected equipment. Coordinate the startup and contractor testing schedules with the COTR and Commissioning Agent. Provide a minimum of 7 days prior notice.

3.3 DEMONSTRATION AND TRAINING

- A. Provide services of manufacturer's technical representative for four hours to instruct VA personnel in operation and maintenance of units.

- - - E N D - - -

THIS PAGE INTENTIONALLY LEFT BLANK

SECTION 26 05 11
REQUIREMENTS FOR ELECTRICAL INSTALLATIONS

PART 1 - GENERAL

1.1 DESCRIPTION

This section applies to all sections of Division 26.

Furnish and install electrical wiring, systems, equipment and accessories in accordance with the specifications and drawings. Capacities and ratings of motors, transformers, cable, switchboards, switchgear, panelboards, motor control centers, generators, automatic transfer switches, and other items and arrangements for the specified items are shown on drawings.

Electrical service entrance equipment and arrangements for temporary and permanent connections to the campus electrical system shall conform to the utility's requirements. Coordinate fuses, circuit breakers and relays with the utility's system, and obtain utility approval for sizes and settings of these devices.

Wiring ampacities specified or shown on the drawings are based on copper conductors, with the conduit and raceways accordingly sized. Aluminum conductors are prohibited.

1.2 MINIMUM REQUIREMENTS

References to the International Building Code (IBC), National Electrical Code (NEC), Underwriters Laboratories, Inc. (UL) and National Fire Protection Association (NFPA) are minimum installation requirement standards.

Drawings and other specification sections shall govern in those instances where requirements are greater than those specified in the above standards.

1.3 TEST STANDARDS

A. All materials and equipment shall be listed, labeled or certified by a nationally recognized testing laboratory to meet Underwriters Laboratories, Inc., standards where test standards have been established. Equipment and materials which are not covered by UL Standards will be accepted provided equipment and material is listed, labeled, certified or otherwise determined to meet safety requirements of a nationally recognized testing laboratory. Equipment of a class which no nationally recognized testing laboratory accepts, certifies, lists, labels, or determines to be safe, will be considered if inspected or tested in accordance with national industrial standards, such as

NEMA, or ANSI. Evidence of compliance shall include certified test reports and definitive shop drawings.

B. Definitions:

1. Listed; Equipment, materials, or services included in a list published by an organization that is acceptable to the authority having jurisdiction and concerned with evaluation of products or services, that maintains periodic inspection of production or listed equipment or materials or periodic evaluation of services, and whose listing states that the equipment, material, or services either meets appropriate designated standards or has been tested and found suitable for a specified purpose.
2. Labeled; Equipment or materials to which has been attached a label, symbol, or other identifying mark of an organization that is acceptable to the authority having jurisdiction and concerned with product evaluation, that maintains periodic inspection of production of labeled equipment or materials, and by whose labeling the manufacturer indicates compliance with appropriate standards or performance in a specified manner.
3. Certified; equipment or product which:
 - Has been tested and found by a nationally recognized testing laboratory to meet nationally recognized standards or to be safe for use in a specified manner.
 - Production of equipment or product is periodically inspected by a nationally recognized testing laboratory.
 - Bears a label, tag, or other record of certification.
4. Nationally recognized testing laboratory; laboratory which is approved, in accordance with OSHA regulations, by the Secretary of Labor.

1.4 QUALIFICATIONS (PRODUCTS AND SERVICES)

Manufacturers Qualifications: The manufacturer shall regularly and presently produce, as one of the manufacturer's principal products, the equipment and material specified for this project, and shall have manufactured the item for at least three years.

Product Qualification:

1. Manufacturer's product shall have been in satisfactory operation, on three installations of similar size and type as this project, for approximately three years.

2. The Government reserves the right to require the Contractor to submit a list of installations where the products have been in operation before approval.

- C. Service Qualifications: There shall be a permanent service organization maintained or trained by the manufacturer which will render satisfactory service to this installation within four hours of receipt of notification that service is needed. Submit name and address of service organizations.

1.5 APPLICABLE PUBLICATIONS

Applicable publications listed in all Sections of Division are the latest issue, unless otherwise noted.

1.6 MANUFACTURED PRODUCTS

- A. Materials and equipment furnished shall be of current production by manufacturers regularly engaged in the manufacture of such items, for which replacement parts shall be available.
- B. When more than one unit of the same class or type of equipment is required, such units shall be the product of a single manufacturer.
- C. Equipment Assemblies and Components:
Components of an assembled unit need not be products of the same manufacturer.
Manufacturers of equipment assemblies, which include components made by others, shall assume complete responsibility for the final assembled unit.
Components shall be compatible with each other and with the total assembly for the intended service.
Constituent parts which are similar shall be the product of a single manufacturer.
- D. Factory wiring shall be identified on the equipment being furnished and on all wiring diagrams.
- E. When Factory Testing Is Specified:
The Government shall have the option of witnessing factory tests. The contractor shall notify the VA through the COTR a minimum of 15 working days prior to the manufacturers making the factory tests. Four copies of certified test reports containing all test data shall be furnished to the COTR prior to final inspection and not more than 90 days after completion of the tests.
When equipment fails to meet factory test and re-inspection is required, the contractor shall be liable for all additional expenses, including expenses of the Government.

1.7 EQUIPMENT REQUIREMENTS

Where variations from the contract requirements are requested in accordance with Section 00 72 00, GENERAL CONDITIONS and Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES, the connecting work and related components shall include, but not be limited to additions or changes to branch circuits, circuit protective devices, conduits, wire, feeders, controls, panels and installation methods.

1.8 EQUIPMENT PROTECTION

- A. Equipment and materials shall be protected during shipment and storage against physical damage, vermin, dirt, corrosive substances, fumes, moisture, cold and rain.

Store equipment indoors in clean dry space with uniform temperature to prevent condensation. Equipment shall include but not be limited to switchgear, switchboards, panelboards, transformers, motor control centers, motor controllers, uninterruptible power systems, enclosures, controllers, circuit protective devices, cables, wire, light fixtures, electronic equipment, and accessories.

During installation, equipment shall be protected against entry of foreign matter; and be vacuum-cleaned both inside and outside before testing and operating. Compressed air shall not be used to clean equipment. Remove loose packing and flammable materials from inside equipment.

Damaged equipment shall be, as determined by the COTR, placed in first class operating condition or be returned to the source of supply for repair or replacement.

Painted surfaces shall be protected with factory installed removable heavy kraft paper, sheet vinyl or equal.

Damaged paint on equipment and materials shall be refinished with the same quality of paint and workmanship as used by the manufacturer so repaired areas are not obvious.

1.9 WORK PERFORMANCE

All electrical work must comply with the requirements of NFPA 70 (NEC), NFPA 70B, NFPA 70E, OSHA Part 1910 subpart J, OSHA Part 1910 subpart S and OSHA Part 1910 subpart K in addition to other references required by contract.

Job site safety and worker safety is the responsibility of the contractor.

- C. Electrical work shall be accomplished with all affected circuits or equipment de-energized. When an electrical outage cannot be accomplished in this manner for the required work, the following requirements are mandatory:

Electricians must use full protective equipment (i.e., certified and tested insulating material to cover exposed energized electrical components, certified and tested insulated tools, etc.) while working on energized systems in accordance with NFPA 70E.

Electricians must wear personal protective equipment while working on energized systems in accordance with NFPA 70E.

Before initiating any work, a job specific work plan must be developed by the contractor with a peer review conducted and documented by the COTR and Medical Center staff. The work plan must include procedures to be used on and near the live electrical equipment, barriers to be installed, safety equipment to be used and exit pathways.

Work on energized circuits or equipment cannot begin until prior written approval is obtained from the COTR.

- D. For work on existing stations, arrange, phase and perform work to assure electrical service for other buildings at all times. Refer to Article OPERATIONS AND STORAGE AREAS under Section 01 00 00, GENERAL REQUIREMENTS.
- E. New work shall be installed and connected to existing work neatly, safely and professionally. Disturbed or damaged work shall be replaced or repaired to its prior conditions, as required by Section 01 00 00, GENERAL REQUIREMENTS.
- F. Coordinate location of equipment and conduit with other trades to minimize interferences.

1.10 EQUIPMENT INSTALLATION AND REQUIREMENTS

Equipment location shall be as close as practical to locations shown on the drawings.

Working spaces shall not be less than specified in the NEC for all voltages specified.

Inaccessible Equipment:

1. Where the Government determines that the Contractor has installed equipment not conveniently accessible for operation and maintenance, the equipment shall be removed and reinstalled as directed at no additional cost to the Government.

2. "Conveniently accessible" is defined as being capable of being reached quickly for operation, maintenance, or inspections without the use of ladders, or without climbing or crawling under or over obstacles such as, but not limited to, motors, pumps, belt guards, transformers, piping, ductwork, conduit and raceways.

1.11 EQUIPMENT IDENTIFICATION

In addition to the requirements of the NEC, install an identification sign which clearly indicates information required for use and maintenance of items such as switchboards and switchgear, panelboards, cabinets, motor controllers (starters), fused and unfused safety switches, automatic transfer switches, separately enclosed circuit breakers, individual breakers and controllers in switchboards, switchgear and motor control assemblies, control devices and other significant equipment.

Nameplates for Normal Power System equipment shall be laminated black phenolic resin with a white core with engraved lettering. Nameplates for Essential Electrical System (EES) equipment, as defined in the NEC, shall be laminated red phenolic resin with a white core with engraved lettering. Lettering shall be a minimum of 1/2 inch [12mm] high. Nameplates shall indicate equipment designation, rated bus amperage, voltage, number of phases, number of wires, and type of EES power branch as applicable. Secure nameplates with screws.

Install adhesive arc flash warning labels on all equipment as required by NFPA 70E. Label shall indicate the arc hazard boundary (inches), working distance (inches), arc flash incident energy at the working distance (calories/cm²), required PPE category and description including the glove rating, voltage rating of the equipment, limited approach distance (inches), restricted approach distance (inches), prohibited approach distance (inches), equipment/bus name, date prepared, and manufacturer name and address.

1.12 SUBMITTALS

Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

The Government's approval shall be obtained for all equipment and material before delivery to the job site. Delivery, storage or installation of equipment or material which has not had prior approval will not be permitted at the job site.

- C. All submittals shall include adequate descriptive literature, catalog cuts, shop drawings and other data necessary for the Government to ascertain that the proposed equipment and materials comply with specification requirements. Catalog cuts submitted for approval shall be legible and clearly identify equipment being submitted.
- D. Submittals for individual systems and equipment assemblies which consist of more than one item or component shall be made for the system or assembly as a whole. Partial submittals will not be considered for approval.

Mark the submittals, "SUBMITTED UNDER SECTION _____".
Submittals shall be marked to show specification reference including the section and paragraph numbers.

Submit each section separately.

- E. The submittals shall include the following:
Information that confirms compliance with contract requirements.
Include the manufacturer's name, model or catalog numbers, catalog information, technical data sheets, shop drawings, pictures, nameplate data and test reports as required.
Elementary and interconnection wiring diagrams for communication and signal systems, control systems and equipment assemblies. All terminal points and wiring shall be identified on wiring diagrams.
Parts list which shall include those replacement parts recommended by the equipment manufacturer.

- F. Manuals: Submit in accordance with Section 01 00 00, GENERAL REQUIREMENTS.

Maintenance and Operation Manuals: Submit as required for systems and equipment specified in the technical sections. Furnish four copies, bound in hardback binders, (manufacturer's standard binders) or an approved equivalent. Furnish one complete manual as specified in the technical section but in no case later than prior to performance of systems or equipment test, and furnish the remaining manuals prior to contract completion.

Inscribe the following identification on the cover: the words "MAINTENANCE AND OPERATION MANUAL," the name and location of the system, equipment, building, name of Contractor, and contract number. Include in the manual the names, addresses, and telephone numbers of each subcontractor installing the system or equipment and the local representatives for the system or equipment.

Provide a "Table of Contents" and assemble the manual to conform to the table of contents, with tab sheets placed before instructions covering the subject. The instructions shall be legible and easily read, with large sheets of drawings folded in.

The manuals shall include:

Internal and interconnecting wiring and control diagrams with data to explain detailed operation and control of the equipment.

A control sequence describing start-up, operation, and shutdown.

Description of the function of each principal item of equipment.

Installation instructions.

Safety precautions for operation and maintenance.

Diagrams and illustrations.

Periodic maintenance and testing procedures and frequencies, including replacement parts numbers and replacement frequencies.

Performance data.

Pictorial "exploded" parts list with part numbers. Emphasis shall be placed on the use of special tools and instruments. The list shall indicate sources of supply, recommended spare parts, and name of servicing organization.

List of factory approved or qualified permanent servicing organizations for equipment repair and periodic testing and maintenance, including addresses and factory certification qualifications.

Approvals will be based on complete submission of manuals together with shop drawings.

After approval and prior to installation, furnish the COTR with one sample of each of the following:

A 300 mm (12 inch) length of each type and size of wire and cable along with the tag from the coils of reels from which the samples were taken.

Each type of conduit coupling, bushing and termination fitting.

Conduit hangers, clamps and supports.

Duct sealing compound.

Each type of receptacle, toggle switch, occupancy sensor, outlet box, manual motor starter, device wall plate, engraved nameplate, wire and cable splicing and terminating material, and branch circuit single pole molded case circuit breaker.

1.13 SINGULAR NUMBER

Where any device or part of equipment is referred to in these specifications in the singular number (e.g., "the switch"), this reference shall be deemed to apply to as many such devices as are required to complete the installation as shown on the drawings.

1.14 ACCEPTANCE CHECKS AND TESTS

The contractor shall furnish the instruments, materials and labor for field tests.

1.15 TRAINING

Training shall be provided in accordance with Article 1.25,

INSTRUCTIONS, of Section 01 00 00, GENERAL REQUIREMENTS.

Training shall be provided for the particular equipment or system as required in each associated specification.

A training schedule shall be developed and submitted by the contractor and approved by the COTR at least 30 days prior to the planned training. - - - E N D

- - -

THIS PAGE INTENTIONALLY LEFT BLANK

**SECTION 26 05 13
MEDIUM VOLTAGE CABLES**

PART 1 - GENERAL

1.1 DESCRIPTION

This section specifies the furnishing, installation, and connection of medium voltage cables, splices, and terminations.

1.2 RELATED WORK

Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS: General electrical requirement and items that are common to more than one section of Division 26.

Section 26 05 26, GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS:

Requirements for personnel safety and to provide a low impedance path for possible ground fault currents.

Section 26 05 33, RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS: Conduits for medium voltage cables.

Section 26 05 41, UNDERGROUND ELECTRICAL CONSTRUCTION: Ducts for medium voltage cables.

Section 31 20 11, EARTH MOVING (Short Form): Bedding of conduits.

1.3 QUALITY ASSURANCE

Refer to Paragraph, QUALIFICATIONS, in Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS.

1.4 FACTORY TESTS

Medium voltage cables shall be thoroughly tested at the factory per NEMA WC 74 to ensure that there are no electrical defects. Factory tests shall be certified.

1.5 SUBMITTALS

A. In accordance with Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS, submit the following:

B. Shop Drawings:

Clearly present sufficient information to determine compliance with drawings and specifications.

Include product and installation information for cables, splices, terminations, and fireproofing tape.

Provide cable minimum bend radius, and flammability data.

C. Samples: After approval and prior to installation, furnish the COTR with a minimum 12 in [300 mm] length of each type and size of cable, along with the tag from the reel from which the sample was taken. The

sample shall contain the manufacturer's markings, showing all cable jacket information.

D. Certifications:

Factory Test Reports: Prior to installation of the cables, deliver four copies of the manufacturers certified NEMA WC 71 or WC 74 standard factory test reports to the COTR. Certified copies of test data shall show conformance with the referenced standards and shall be approved prior to delivery of cable.

Compatibility: Provide certification from the cable manufacturer that the splices and terminations are approved for use with the cable.

Field Test Reports: Test reports shall comply with the paragraph entitled "Acceptance Checks and Tests." After testing, submit four certified copies to the COTR of each of the graphs specified under field testing.

After splices and terminations have been installed and tested, deliver four copies of a certificate by the contractor to the COTR which includes the following:

A statement that the materials, detail drawings, and printed instructions used are those contained in the kits approved for this contract.

A statement that each splice and each termination was completely installed in a single continuous work period by a single qualified worker without any overnight interruption.

A statement that field-made splices and terminations conform to the following requirements:

- 1) Pencil the cable insulation precisely.
- 2) Connector installations:
 - Use tools that are designed for the connectors being installed.
 - Round and smooth the installed connectors to minimize localized voltage stressing of the insulating materials.
- 3) Remove contaminants from all surfaces within the splices and terminations before installing the insulating materials.
- 4) Solder block throughout stranded grounding wires that might penetrate the splicing and terminating materials.
- 5) Use mirrors to observe the installation of materials on the backsides of the splices and terminations.

Eliminate air voids throughout the splices and terminations.
Stretch each layer of tape properly during installation.

- d. List all the materials purchased and installed for the splices and terminations for this contract, including the material descriptions, manufacturers' names, catalog numbers, and total quantities.
- E. Installer Approval:

Employees who install splices and terminations and test the cables shall have not fewer than five years of experience splicing and terminating cables equivalent to those being spliced and terminated, including experience with the materials in the kits. Furnish satisfactory proof of such experience for each employee who splices or terminates the cables.

F. CABLE VOLTAGE RATINGS:1. MEDIUM VOLTAGE POWER CABLES SHALL INCLUDE MULTIPLE AND SINGLE-CONDUCTOR CABLE RATED 15,000 VOLTS ON 12,470V.3 PHASE, 60HZ DISTRIBUTION SYSTEMS.1.6 APPLICABLE PUBLICATIONS

Publications listed below (including amendments, addenda, revisions, supplements, and errata) form a part of this specification to the extent referenced. Publications are referenced in the text by designation only:

American Society for Testing and Materials (ASTM):

B3-01 (R2007) Standard Specification for Soft or Annealed
Copper Wire

Institute of Electrical and Electronics Engineers, Inc. (IEEE):

386-95 (R2001) Separable Insulated Connector Systems for Power
Distribution Systems above 600 V

400-01 Guide for Field Testing and Evaluation of the
Insulation of Shielded Power Cable Systems

400.2-05 Guide for Field Testing of Shielded Power Cable
Systems Using Very Low Frequency (VLF)

400.3-06 Guide for Partial Discharge Testing of Shielded
Power Cable Systems in a Field Environment

404-00 Extruded and Laminated Dielectric Shielded
Cable Joints Rated 2500-500,000 Volts

National Electrical Manufacturers Association (NEMA):

WC 71-99 Standard for Non-Shielded Cables Rated 2001-
5000 Volts for Use in the Distribution of
Electrical Energy (ICEA S-96-659)

WC 74-06 5-46 KV Shielded Power Cable for Use in the
Transmission and Distribution of Electrical
Energy (ICEA S-93-969)

National Fire Protection Association (NFPA):

70-08 National Electrical Code (NEC)

Underwriters Laboratories (UL):

1072-06 Medium-Voltage Power Cables

1.7 SHIPMENT AND STORAGE

Cable shall be shipped on reels such that it is protected from mechanical injury. Each end of each length of cable shall be hermetically sealed with manufacturer's end caps and securely attached to the reel.

Cable stored and/or cut on site shall have the ends turned down, and sealed with cable manufacturer's standard cable end seals, or field-installed heat-shrink cable end seals.

PART 2 - PRODUCTS

2.1 MATERIAL MEDIUM VOLTAGE CABLE

- A. Cable Type: MV105.
- B. Comply with UL 1072, AEIC CS 8, ICEA S-94-649.
- C. Conductor: Copper.
- D. Conductor Stranding: Compact stranded per ASTM B-496.
- E. Strand Screen: Extruded semiconducting EPR strand screen meeting or exceeding electrical and physical requirements of ICEA S-93-639/NEMA WC74 and UL 1072.
- F. Insulation Screen: Extruded semiconducting EPR insulation screen meeting or exceeding electrical and physical requirements of ICEA S-93-639/NEMA WC74 and UL 1072.
- G. Conductor Insulation: Ethylene-propylene rubber, ICEA S-93-639/NEMA WC74 and UL 1072.
Voltage Rating: 15 kV or 5kV per the application.
Insulation Thickness: 133 percent insulation level.
- H. Shielding: 5 mil uncoated copper tape with 12.5% nominal overlap or as required to meet or exceed the available fault current.
- I. Assembly: Provide single and three conductor cable assembly types:
 - 1. Three-Conductor Cable Assembly: Three insulated, shielded conductors cabled together with ground conductors.
 - a. Circuit Identification: Color-coded tape (black, red, blue) under the metallic shielding.

Grounding Conductor: Uncoated copper in accordance with UL 1072.

Cable Armor: Corrugated, interlocked aluminum per UL 1072.

Cable Jacket: Sunlight-resistant PVC. UL Listed as type MV-105 for use in cable tray and for direct burial in accordance in accordance with UL 1072 and UL 2225. Conform to applicable requirements of IEC 60502, 60332-3, and IEEE 1580.

2. Single-Conductor Cable Assembly: Single insulated, shielded conductor.

- a. Cable Jacket: ICEA S-93-639/NEMA WC74 & S-97-682 and UL 1072 for polyvinyl chloride jackets. UL Listed as Type MV-105 and sunlight resistant in accordance with UL 1072. UL Listed as type MV-105 for use in cable tray where indicated and for direct burial in accordance with UL 1072 and UL 2225.

Heavy duty, overall protective jackets of chlorosulphonated polyethylene, neoprene, or polyvinyl chloride shall enclose every cable. Color shall be black or yellow for normal power circuits, red or orange for emergency circuits.

Cable temperature ratings for continuous operation, emergency overload operation and short circuit operation shall be not less than the NEC, NEMA WC74 Standard for the respective cable.

Manufacturer's name and other pertinent information shall be marked or molded clearly on the overall outside surface of the jackets, or incorporated on marker tapes within the cables at reasonable intervals.

2.2 MATERIAL, SEPARABLE INSULATED CONNECTORS

Description: Modular system, complying with IEEE 386, with disconnecting, single-pole, cable terminators and with matching, stationary, plug-in, dead-front terminals designed for cable voltage and for sealing against moisture.

Terminations at Distribution Points: Modular type, consisting of terminators installed on cables and modular, dead-front, terminal junctions for interconnecting cables.

Load-Break Cable Terminators: Elbow-type units with 200-A load make/break and continuous-current rating; coordinated with insulation

diameter, conductor size, and material of cable being terminated. Include test point on terminator body that is capacitance coupled.

- D. Dead-Front Terminal Junctions: Modular bracket-mounted groups of dead-front stationary terminals that mate and match with above cable terminators. Two-, three-, or four-terminal units as indicated, with fully rated, insulated, watertight conductor connection between terminals and complete with grounding lug, manufacturer's standard accessory stands, stainless-steel mounting brackets, and attaching hardware.

Protective Cap: Insulating, electrostatic-shielding, water-sealing cap with drain wire. Plastic shipping caps are not acceptable.

Portable Feed-Through Accessory: Two-terminal, dead-front junction arranged for removable mounting on accessory stand of stationary terminal junction.

Grounding Kit: Jumpered elbows, portable feed-through accessory units, protective caps, test rods suitable for concurrently grounding three phases of feeders, and carrying case.

Standoff Insulator: Portable, single dead-front terminal for removable mounting on accessory stand of stationary terminal junction. Insulators suitable for fully insulated isolation of energized cable-elbow terminator.

- E. Test-Point Fault Indicators: Applicable current-trip ratings arranged for installation in test points of load-break separable connectors, and complete with self-resetting indicators capable of being installed with shotgun hot stick and tested with test tool.

- F. Tool Set: Shotgun hot stick with energized terminal indicator, fault-indicator test tool, and carrying case. 2.3

MATERIAL, INLINE SPLICES AND SPLICE KITS

The materials shall be compatible with the conductors, insulations, and protective jackets on the cables and wires.

The splices shall insulate and protect the conductors not less than the insulation and protective jackets on the cables and wires that protect the conductors. In locations where moisture might be present, the splices shall be watertight. In manholes and hand-holes the splices shall be submersible.

Splicing and Terminating Fittings: Shall be in accordance with IEEE 386, 404.

Shall be heavy duty, pressure type fittings, which will assure satisfactory performance of the connections under conditions of temperature cycling and magnetic forces from available short circuit currents.

The fittings shall be suitably designed and the proper size for the cables and wires being spliced and terminated. Terminations to bus shall be with two hole lugs.

Where the Government determines that unsatisfactory fittings have been installed, contractor shall replace the unsatisfactory installations with approved fittings at no additional cost to the Government.

D. Spicing and Terminating Kits:

1. General:

Shall be assembled by the manufacturer or supplier of the materials and shall be packaged for individual splices and terminations or for groups of splices and terminations. Shall consist of materials designed for the cables being spliced and terminated and shall be suitable for submerged locations.

Where splicing armored, three-conductor cable assemblies only kits designed specifically for splicing armored, three-conductor cable assemblies shall be used.

Shall include detail drawings and printed instructions for each type of splice and termination being installed, as prepared by the manufacturers of the materials in the kits.

Detail drawings, and printed instructions shall indicate the cable type, voltage rating, manufacturer's name, and catalog numbers for the materials indicated.

Voltage ratings for the splices and terminations shall be not less than the voltage ratings for the cables on which they are being installed.

Shall include shielding and stress cone materials.

E. Pre-molded Rubber splices and Terminations:

1. Splices and terminations shall be in accordance with IEEE 386, and 404.

Pre-molded rubber devices shall have a minimum of 0.125 inch semi-conductive shield material covering the entire housing.

Test each rubber part prior to shipment from the factory.

Grounding of metallic shields shall be accomplished by a solderless connector enclosed in a watertight rubber housing covering the entire assembly. The grounding device and splice or terminator shall be of the same manufacturer to insure electrical integrity of the shielded parts.

The pre-molded parts shall be suitable for submersible applications.

2.4 MATERIAL, FIREPROOFING TAPE

The tape shall consist of a flexible, conformable fabric of organic composition coated one side with flame-retardant elastomer.

The tape shall be self-extinguishing and shall not support combustion. It shall be arc proof and fireproof.

The tape shall not deteriorate when subjected to water, gases, salt water, sewage or fungus. It shall be resistant to sunlight and ultraviolet light.

The finished application shall withstand a 200-ampere arc for not less than 30 seconds.

Securing tape: Shall be glass cloth electrical tape not less than 7 mils thick, and 3/4 inch wide.

2.5 MATERIAL, WARNING TAPE

The tape shall be standard, 3 inch wide, 4-Mil polyethylene detectable type with aluminum backing.

The tape shall be red with black letters indicating "CAUTION BURIED ELECTRICAL LINE BELOW".

PART 3 - EXECUTION

3.1 INSTALLATION, MEDIUM VOLTAGE CABLE

Installation shall be in accordance with the NEC, as shown on the drawings, and per cable manufacturer's instructions.

Normal and Emergency Loop Feeders shall be of the armored three-conductor cable assembly type as specified in Part 2 of this specification.

Emergency Transformer Feeders shall be of the armored three-conductor cable assembly type as specified in Part 2 of this specification.

Normal Transformer Feeders shall be of the single-conductor or three-conductor cable assembly type as specified in Part 2 of this specification.

Contractor shall ensure that radii of bends fittings, cable risers, and other conditions are suitable for the cable and conform with the recommendations of the cable manufacturer.

Cable shall be installed in underground duct banks and manholes on wall mounted non-ferrous racks.

Cables shall be secured with PVC coated metallic non-metallic cable clamps, straps, hangers, or other approved supporting devices to tunnel walls, ceilings.

Cable or conductors of a primary distribution system shall be rejected when installed openly in cable trays or openly racked along interior walls of buildings; in the same raceway or conduit with AC/DC control circuits or ac power circuits operating at less than 600 volts; or in a manner allowing cable to support its own weight.

Use suitable lubricating compounds on the cables and wires to prevent damage to them during pulling-in. Provide compounds that are not injurious to the cable and wire jackets and do not harden or become adhesive.

Terminate the cables and wires only above ground at load-break junction cabinets. Ground shields in accordance with Section 26 05 26, GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS.

In manholes and vaults install the cables on non-ferrous cable racks. Ground cable shields in accordance with Section 26 05 26, GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS.

In manholes, underground raceways and other outdoors locations:

Seal the cable ends prior to pulling them in to prevent the entry of moisture.

For ethylene propylene rubber insulated cables, use bags of epoxy resin that are not less than 1/4 inch larger in diameter than overall diameter of the cable. Clean each end of each cable before installing the epoxy resin over it.

Utilize in-line splices where needed to facilitate pulls and where sufficient space exists for racking, splicing, and bending the cable without exceeding code-allowed and manufacturer-allowed bending radius. Refer to the paragraph "SEPARATION OF NORMAL AND EMERGENCY FEEDERS" in this section for further restrictions.

3.2 SEPARATION OF NORMAL AND EMERGENCY FEEDERS

- A. The Normal Feeders and the Emergency Feeders shall be physically separated by cable armor in all locations. Where pull calculations indicate that a feeder must be spliced to facilitate the pull, only that one feeder will be spliced at the location. The other feeder, if required to be spliced, shall be spliced in a different manhole where no other splices exist.

3.3 PROTECTION DURING SPLICING OPERATIONS

- A. Blowers shall be provided to force fresh air into manholes or confined areas where free movement or circulation of air is obstructed. Waterproof protective coverings shall be available on the work site to provide protection against moisture while a splice is being made. Under no conditions shall a termination be made with the interior of a cable exposed to moisture. Conductor insulation paper shall be moisture-tested before the termination is made. A manhole ring at least 6 inches above ground shall be used around the manhole entrance to keep surface water from entering the manhole. Unused ducts shall be plugged and water seepage through ducts in use shall be stopped before the termination is started.

3.4 PULLING CABLE IN DUCTS, MANHOLES AND UTILITY TUNNELS

Medium-voltage cables shall be pulled into ducts and utility tunnels with equipment designed for this purpose, including power-driven winch, cable-feeding flexible tube guide, cable grips, and lubricants. A sufficient number of trained personnel and equipment shall be employed to ensure the careful and proper installation of the cable.

Cable reel shall be set up at the side of the manhole or tunnel hatch opening and above the duct or hatch level, allowing the cable to enter through the opening without reverse bending. Flexible tube guide shall be installed through the opening in a manner that will prevent the cable from rubbing on the edges of any structural member.

Pulling force for a cable grip shall not exceed manufacturer's recommendation. A dynamometer shall be used in the pulling line to ensure that the pulling force is not exceeded.

Cable shall be unreeled from the top of the reel. Payout shall be carefully controlled. Cable to be pulled shall be attached through a swivel to the main pulling wire by means of a pulling eye.

Woven-wire cable grips shall be used to grip the cable end when pulling small cables and short straight lengths of heavier cables.

Pulling eyes shall be attached to the cable conductors to prevent damage to the cable structure.

Cables shall be liberally coated with a suitable cable-pulling lubricant as it enters the tube guide or duct. Rollers, sheaves, or tube guides around which the cable is pulled shall conform to the minimum bending radius of the cable.

Cables shall be pulled into ducts at a reasonable speed not in excess of maximum permissible pulling tension specified by the cable manufacturer. Cable pulling using a vehicle shall not be permitted. Pulling operations shall be stopped immediately with any indication of binding or obstruction and shall not be resumed until such difficulty is corrected. Sufficient slack shall be provided for free movement of cable due to expansion or contraction.

Cable splices made up in manholes or utility tunnels shall be firmly supported on cable racks as indicated. No cable splices shall be pulled in ducts. Cable ends shall overlap at the ends of a section to provide sufficient undamaged cable for splicing. Cables to be spliced in manholes or utility tunnels shall overlap the centerline of the proposed joint by not less than 2 feet.

Cables cut in the field shall have the cut ends immediately sealed to prevent entrance of moisture. Cables shall be sealed with rubber tape wrapped down to 3 inches from the cable end. Rubber tape shall be cover-wrapped with polyvinylchloride tape.

3.5 INSTALLATION, SEPARABLE INSULATED CONNECTORS

Install the materials as recommended by their manufacturer including special precautions pertaining to air temperature during installation. Separable insulated connectors shall not be stacked. Provide equipment with electrically connected junctions.

Loop feeder terminations shall be made above ground using 600 Amp separable insulated bolted connections.

Transformer feeder terminations shall be made above ground using 200 Amp separable insulated "hot-stick operated" connections.

Installation shall be accomplished by qualified personnel trained to accomplish medium voltage equipment installations. All instructions of the manufacturer shall be followed in detail.

Installation shall include built-up or prefabricated heat or cold shrink stress-relief cones at the existing substation switchgear breaker secondary terminals of all shielded cabled.

supplied by and in accordance with cable manufacturer's recommendations for the type, size, and electrical characteristics of the cable specified. Cable splices in manholes shall be located midway between cable racks on walls of manholes and supported with cable arms at approximately the same elevation as the enclosing duct. Rack splices on the widest wall of the manhole except that it shall be acceptable to use the narrow wall when the narrower wall allows sufficient space to meet the larger of the bend radius requirements specified by the manufacturer and in the National Electrical Code. Cable connectors shall be high-conductivity copper accurately machined and threaded for internal and external electrical connections. Cross-sectional and contact areas shall be adequate to carry the full-load current rating of the conductors. Cable connectors shall be solder type with gasket seal between the connector and bushing.

3.6 INSTALLATION, JUNCTION CABINETS

Install junction cabinets on concrete pads.

Pads shall be a minimum of 6" thick, 3000 psi reinforce concrete and shall extend 4" from the outer edge of the cabinet in all directions.

Install electrical equipment grounding conductor from manhole to equipment in accordance with Section 26 05 26, GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS.

3.7 INSTALLATION, FIREPROOFING

Cover all non-armored power cables and non-armored splice kits located in manholes, hand-holes and junction boxes with arc proof and fireproof tape.

Apply the tape in a single layer, one-half lapped or as recommended by the manufacturer. Install the tape with the coated side towards the cable and extend it not less than one inch into each duct.

Secure the tape in place by a random wrap of glass cloth tape.

3.8 FEEDER IDENTIFICATION

A. In each manhole and pull-box install permanent tags on each circuit's cables and wires to clearly designate their circuit identification and voltage. In manholes the tags shall be the embossed brass type and shall also show the cable type and voltage rating. Position the tags so they will be easy to read after the fireproofing is installed.

3.9 FIELD TESTS FOR MEDIUM VOLTAGE CABLE

A. New Cable:

Acceptance tests shall be performed on new cables in accordance with IEEE 400.2 and as specified herein.

Test new cable after installation, splices, and terminations have been made, but before connection to equipment and existing cable.

Test equipment, labor, and technical personnel shall be provided as necessary to perform the electrical acceptance tests.

Arrangements shall be made to have tests witnessed by the COTR.

B. Dielectric Absorptions Test: Cable shall be completely isolated from extraneous electrical connections at cable terminations and joints. Safety precautions shall be observed. Each cable shall be given a full dielectric - absorption test with a 5000v insulation resistance test set. Test shall be applied for a long enough time to charge the cable. Readings shall be recorded every 15 seconds during the first 3 minutes of test and at 1 minute intervals thereafter. Test shall continue until three equal readings 1 minute apart are obtained. Minimum readings shall be 200 megohms at an ambient temperature 20 degrees C (68 degrees F). Readings taken at other temperatures shall be corrected accordingly.

C. High Potential Test: High potential test shall not be applied to the service aged cables. All other cables shall be subjected to the test but only upon successful dielectric absorption test.

Leakage current test shall be by high potential dc step voltage method.

High potential test shall measure the leakage current from each conductor to the insulation shield. Use corona shields, guard rings, taping, mason jars, or plastic bags to prevent corona current from influencing the readings. Unprepared cable shield ends shall be trimmed back 1 inch or more for each 10kV of test voltage. Upon the successful completion of the high potential test on new and service aged PE CCLP, PC PVC cables a second dielectric test will be run on the HV cable system to ensure the cables have not been damaged by the hi-pot test.

D. Safety Precautions:

1. Exercise suitable and adequate safety measures prior to, during, and after the high potential tests, including placing warning signs and preventing people and equipment from being exposed to the test voltages.

E. Test Voltages:

New shielded EPR cable dc test voltages shall be as follows:

Rated Circuit Voltage Phase-to-Phase Volt	Wire Size AWG or MCM	Test Voltage KV
2001-5000	8-1000	25
5001-8000	6-1000	35
8001-15000	2-1000	65
15001-25001	1-1000	100
25001-28000	1-1000	-
28001-35000	1/0-1000	-

Existing cable of all types interconnected to a new cable shall be tested at 1.7 times the existing cable rated voltage (maintenance test).

F. High Potential Test Method:

1. Apply voltage in approximately 8 to 10 equal steps.
2. Raise the voltage slowly between steps.
3. At the end of each step, allow the charging currents to decay, and time the interval of decay.
4. Read the leakage current and plot a curve of leakage currents versus test voltage on graph paper as the test progresses. Read the leakage current at the same time interval for each voltage step.
5. Stop the test if leakage currents increase excessively or a "knee" appears in the curve before maximum test voltage is reached.

For new cable, repair or replace the cable and repeat the test.

For existing cable interconnected to new cable, notify the COTR for further instructions.

6. Upon reaching maximum test voltage, hold the voltage for five minutes. Read the leakage current at 30 second intervals and plot a curve of leakage current versus time on the same graph paper as the step voltage curve. Stop the test if leakage current starts to rise, or decreases and again starts to rise. Leakage current should decrease and stabilize for good cable.
7. Terminate test and allow sufficient discharge time before testing the next conductor.

Test Data: Test data shall be recorded and shall include identification of cable and location, megohm readings versus time, leakage current readings versus time, and cable temperature versus time.

Final Acceptance: Final acceptance shall depend upon the satisfactory performance of the cable under test. No cable shall be energized until recorded test data have been approved by the COTR. Final test reports shall be provided to the COTR. Reports shall have a cover letter/sheet clearly marked with the System name, Date and the words "Final Test Report". Forward to the COTR for inclusion in the maintenance database.

Radiographic Tests: Radiographic tests shall be performed on all potheads at the discretion of the COTR to determine if voids exist in the pothead. Unacceptable terminations shall be reworked at no additional expense to the Government.

The contractor shall furnish the instruments, materials and labor for these tests.

- - - E N D - - -

THIS PAGE INTENTIONALLY LEFT BLANK

SECTION 26 05 21
LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES (600 VOLTS AND BELOW)

PART 1 - GENERAL

1.1 DESCRIPTION

This section specifies the furnishing, installation, and connection of the low voltage power and lighting wiring.

1.2 RELATED WORK

Section 07 84 00, FIRESTOPPING: Sealing around penetrations to maintain the integrity of fire-rated construction.

Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS: General electrical requirements that are common to more than one section.

Section 26 05 26, GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS:

Requirements for personnel safety and to provide a low impedance path for possible ground fault currents.

Section 26 05 33, RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS: Conduits for cables and wiring.

Section 26 05 41, UNDERGROUND ELECTRICAL CONSTRUCTION: Installation of low-voltage conductors and cables in manholes and ducts.

1.3 QUALITY ASSURANCE

Refer to Paragraph, QUALIFICATIONS, in Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS.

1.4 FACTORY TESTS

Low voltage cables shall be thoroughly tested at the factory per NEMA WC-70 to ensure that there are no electrical defects. Factory tests shall be certified.

1.5 SUBMITTALS

In accordance with Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS, submit the following:

Manufacturer's Literature and Data: Showing each cable type and rating.

Certifications: Two weeks prior to the final inspection, submit four copies of the following certifications to the COTR:

Certification by the manufacturer that the materials conform to the requirements of the drawings and specifications.

Certification by the contractor that the materials have been properly installed, connected, and tested.

1.6 APPLICABLE PUBLICATIONS

Publications listed below (including amendments, addenda, revisions, supplements and errata) form a part of this specification to the extent referenced. Publications are reference in the text by designation only.

American Society of Testing Material (ASTM):

D2301-04Standard Specification for Vinyl Chloride
Plastic Pressure-Sensitive Electrical Insulating
Tape

National Fire Protection Association (NFPA):

70-08 National Electrical Code (NEC)

National Electrical Manufacturers Association (NEMA):

WC 70-09 Power Cables Rated 2000 Volts or Less for the
Distribution of Electrical Energy

Underwriters Laboratories, Inc. (UL):

44-05Thermoset-Insulated Wires and Cables

83-08Thermoplastic-Insulated Wires and Cables

467-071Electrical Grounding and Bonding Equipment

486A-486B-03Wire Connectors

486C-04Splicing Wire Connectors

486D-05Sealed Wire Connector Systems

486E-94 Equipment Wiring Terminals for Use with Aluminum
and/or Copper Conductors

493-07 Thermoplastic-Insulated Underground Feeder and
Branch Circuit Cable

514B-04Conduit, Tubing, and Cable Fittings

1479-03Fire Tests of Through-Penetration Fire Stops

PART 2 - PRODUCTS

2.1 CONDUCTORS AND CABLES

A. Conductors and cables shall be in accordance with NEMA WC-70 and as specified herein.

B. Single Conductor:

Shall be annealed copper.

Shall be stranded for sizes No. 12 AWG and larger.

Shall be minimum size No. 12 AWG, except where smaller sizes are allowed herein.

C. Insulation:

1. XHHW-2 or THHN-THWN shall be in accordance with NEMA WC-70, UL 44, and UL 83.

D. Color Code:

1. Secondary service feeder and branch circuit conductors shall be color-coded as follows:

208/120 volt	Phase	480/277 volt
Black	A	Brown
Red	B	Orange
Blue	C	Yellow
White	Neutral	Gray *
* or white with colored (other than green) tracer.		

- a. Lighting circuit "switch legs" and 3-way switch "traveling wires" shall have color coding that is unique and distinct (e.g., pink and purple) from the color coding indicated above. The unique color codes shall be solid and in accordance with the NEC. Coordinate color coding in the field with the COTR.
2. Use solid color insulation or solid color coating for No. 12 AWG and No. 10 AWG branch circuit phase, neutral, and ground conductors.
3. Conductors No. 8 AWG and larger shall be color-coded using one of the following methods:
 - Solid color insulation or solid color coating.
 - Stripes, bands, or hash marks of color specified above.
 - Color as specified using 0.75 in [19 mm] wide tape. Apply tape in half-overlapping turns for a minimum of 3 in [75 mm] for terminal points, and in junction boxes, pull-boxes, troughs, and manholes. Apply the last two laps of tape with no tension to prevent possible unwinding. Where cable markings are covered by tape, apply tags to cable, stating size and insulation type.
4. For modifications and additions to existing wiring systems, color coding shall conform to the existing wiring system.

2.2 SPLICES AND JOINTS

In accordance with UL 486A, C, D, E, and NEC.

Aboveground Circuits (No. 10 AWG and smaller):

Connectors: Solderless, screw-on, reusable pressure cable type, rated 600 V, 220• F [105• C], with integral insulation, approved for copper and aluminum conductors.

The integral insulator shall have a skirt to completely cover the stripped wires.

3. The number, size, and combination of conductors, as listed on the manufacturer's packaging, shall be strictly followed.

C. Aboveground Circuits (No. 8 AWG and larger):

Connectors shall be indent, hex screw, or bolt clamp-type of high conductivity and corrosion-resistant material, listed for use with copper and aluminum conductors.

Field-installed compression connectors for cable sizes 250 kcmil and larger shall have not fewer than two clamping elements or compression indents per wire.

Insulate splices and joints with materials approved for the particular use, location, voltage, and temperature. Splice and joint insulation level shall be not less than the insulation level of the conductors being joined.

Plastic electrical insulating tape: Per ASTM D2304, flame-retardant, cold and weather resistant.

D. Underground Branch Circuits and Feeders:

1. Submersible connectors in accordance with UL 486D, rated 600 V, 190• F [90• C], with integral insulation. 2.3

CONTROL WIRING

Unless otherwise specified elsewhere in these specifications, control wiring shall be as specified for power and lighting wiring, except that the minimum size shall be not less than No. 14 AWG.

Control wiring shall be large enough such that the voltage drop under in-rush conditions does not adversely affect operation of the controls.

2.4 WIRE LUBRICATING COMPOUND

A. Lubricating compound shall be suitable for the wire insulation and conduit, and shall not harden or become adhesive.

PART 3 - EXECUTION

3.1 GENERAL

Install in accordance with the NEC, and as specified.

Provide a separate neutral for each 120 and 277 Volt circuit. The use of "Edison Circuits", one neutral serving more than one circuit, is not permitted.

Install all wiring in raceway systems.

Splice cables and wires only in outlet boxes, junction boxes, pull-boxes, manholes, or handholes.

Wires of different systems (e.g., 120 V, 277 V) shall not be installed in the same conduit or junction box system.

- F. Install cable supports for all vertical feeders in accordance with the NEC. Provide split wedge type which firmly clamps each individual cable and tightens due to cable weight.
- G. For panel boards, cabinets, wireways, switches, and equipment assemblies, neatly form, train, and tie the cables in individual circuits.
- H. Seal cable and wire entering a building from underground between the wire and conduit where the cable exits the conduit, with a non-hardening approved compound.
- I. Wire Pulling:
 - Provide installation equipment that will prevent the cutting or abrasion of insulation during pulling of cables. Use lubricants approved for the cable.
 - Use nonmetallic ropes for pulling feeders.
 - Attach pulling lines for feeders by means of either woven basket grips or pulling eyes attached directly to the conductors, as approved by the COTR.
 - All cables in a single conduit shall be pulled simultaneously.
 - Do not exceed manufacturer's recommended maximum pulling tensions and sidewall pressure values.
- J. No more than three single-phase branch circuits shall be installed in any one conduit.

3.2 SPLICE INSTALLATION

Splices and terminations shall be mechanically and electrically secure. Tighten electrical connectors and terminals according to manufacturer's published torque values.

Where the Government determines that unsatisfactory splices or terminations have been installed, remove the devices and install approved devices at no additional cost to the Government.

3.3 FEEDER IDENTIFICATION

In each interior pull-box and junction box, install metal tags on all circuit cables and wires to clearly designate their circuit identification and voltage. The tags shall be the embossed brass type, 1.5 in [40 mm] in diameter and 40 mils thick. Attach tags with plastic ties.

In each handhole, provide tags of the embossed brass type, showing the circuit identification and voltage. The tags shall be the embossed brass type, 1.5 in [40 mm] in diameter and 40 mils thick. Attach tags with plastic ties.

3.4 CONTROL AND SIGNAL WIRING INSTALLATION

Unless otherwise specified in other sections, install wiring and connect to equipment/devices to perform the required functions as shown and specified.

Except where otherwise required, install a separate power supply circuit for each system so that malfunctions in any system will not affect other systems.

Where separate power supply circuits are not shown, connect the systems to the nearest panel boards of suitable voltages, which are intended to supply such systems and have suitable spare circuit breakers or space for installation.

3.5 CONTROL AND SIGNAL SYSTEM WIRING IDENTIFICATION

Install a permanent wire marker on each wire at each termination. Identifying numbers and letters on the wire markers shall correspond to those on the wiring diagrams used for installing the systems.

Wire markers shall retain their markings after cleaning.

In each handhole, install embossed brass tags to identify the system served and function.

3.6 ACCEPTANCE CHECKS AND TESTS

Feeders and branch circuits shall have their insulation tested after installation and before connection to utilization devices, such as fixtures, motors, or appliances. Test each conductor with respect to adjacent conductors and to ground. Existing conductors to be reused shall also be tested.

Applied voltage shall be 500VDC for 300-volt rated cable, and 1000VDC for 600-volt rated cable. Apply test for one minute or until reading is constant for 15 seconds, whichever is longer. Minimum insulation resistance values shall not be less than 25 megohms for 300-volt rated cable and 100 megohms for 600-volt rated cable.

Perform phase rotation test on all three-phase circuits.

The contractor shall furnish the instruments, materials, and labor for all tests.

- - - E N D - - -

SECTION 26 05 26
GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 DESCRIPTION

This section specifies the general grounding and bonding requirements for electrical equipment and operations to provide a low impedance path for possible ground fault currents.

"Grounding electrode system" refers to all electrodes required by NEC, as well as made, and supplementary, grounding electrodes.

The terms "connect" and "bond" are used interchangeably in this specification and have the same meaning.

1.2 RELATED WORK

Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS: General electrical requirements and items that are common to more than one section of Division 26.

Section 26 05 21, LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES (600 VOLTS AND BELOW): Low Voltage power and lighting wiring.

Section 26 22 00, LOW-VOLTAGE TRANSFORMERS: Low voltage transformers.

Section 26 24 11, DISTRIBUTION SWITCHBOARDS: Low voltage distribution switchboards.

Section 26 24 16, PANELBOARDS: Low voltage panelboards.

1.3 QUALITY ASSURANCE

Refer to Paragraph, QUALIFICATIONS, in Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS.

1.4 SUBMITTALS

A. Submit in accordance with Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS.

B. Shop Drawings:

Clearly present enough information to determine compliance with drawings and specifications.

Include the location of system grounding electrode connections and the routing of aboveground and underground grounding electrode conductors.

C. Test Reports: Provide certified test reports of ground resistance.

D. Certifications: Two weeks prior to final inspection, submit four copies of the following to the COTR:

1. Certification that the materials and installation are in accordance with the drawings and specifications.

2. Certification by the contractor that the complete installation has been properly installed and tested.

1.5 APPLICABLE PUBLICATIONS

Publications listed below (including amendments, addenda, revisions, supplements, and errata) form a part of this specification to the extent referenced. Publications are referenced in the text by designation only.

American Society for Testing and Materials (ASTM):

- B1-07 Standard Specification for Hard-Drawn Copper Wire
- B3-07 Standard Specification for Soft or Annealed Copper Wire
- B8-04 Standard Specification for Concentric-Lay-Stranded Copper Conductors, Hard, Medium-Hard, or Soft

Institute of Electrical and Electronics Engineers, Inc. (IEEE):

- 81-1983 IEEE Guide for Measuring Earth Resistivity, Ground Impedance, and Earth Surface Potentials of a Ground System
- C2-07 National Electrical Safety Code

National Fire Protection Association (NFPA):

- 70-08 National Electrical Code (NEC)
- 99-2005 Health Care Facilities

Underwriters Laboratories, Inc. (UL):

- 44-05 Thermoset-Insulated Wires and Cables
- 83-08 Thermoplastic-Insulated Wires and Cables
- 467-07 Grounding and Bonding Equipment
- 486A-486B-03 Wire Connectors

PART 2 - PRODUCTS

2.1 GROUNDING AND BONDING CONDUCTORS

Equipment grounding conductors, #12 and larger, shall be UL 44 or UL 83 insulated stranded copper. Insulation color shall be continuous green for all equipment grounding conductors, except that wire sizes No. 4 AWG [25 mm²] and larger shall be identified per NEC.

Bonding conductors shall be ASTM B8 bare stranded copper, except that sizes No. 10 AWG [6 mm²] and smaller shall be ASTM B1 solid bare copper wire.

C. Conductor sizes shall not be less than shown on the drawings, or not less than required by the NEC, whichever is greater.

2.2 GROUND RODS

Steel or copper clad steel, 0.75 in [19 mm] diameter by 10 ft [30 M] long, conforming to UL 467.

Quantity of rods shall be as required to obtain the specified ground resistance, as shown on the drawings.

2.3 CONCRETE ENCASED ELECTRODE

Concrete encased electrode shall be No. 4 AWG bare copper wire, installed per NEC.

2.4 MEDIUM VOLTAGE SPLICES AND TERMINATIONS

Components shall meet or exceed UL 467 and be clearly marked with the manufacturer, catalog number, and permitted conductor size(s).

2.5 GROUND CONNECTIONS

A. Below Grade: Exothermic-welded type connectors.

B. Above Grade:

Bonding Jumpers: Compression-type connectors, using zinc-plated fasteners and external tooth lockwashers.

Connection to Building Steel: Exothermic-welded type connectors.

Ground Busbars: Two-hole compression type lugs, using tin-plated copper or copper alloy bolts and nuts.

Rack and Cabinet Ground Bars: One-hole compression-type lugs, using zinc-plated or copper alloy fasteners.

2.6 EQUIPMENT RACK AND CABINET GROUND BARS

Provide solid copper ground bars designed for mounting on the framework of open or cabinet-enclosed equipment racks with minimum dimensions of 0.375 in [4 mm] thick x 0.75 in [19 mm] wide.

2.7 GROUND TERMINAL BLOCKS

At any equipment mounting location (e.g., backboards and hinged cover enclosures) where rack-type ground bars cannot be mounted, provide screw lug-type terminal blocks.

2.8 GROUNDING BUS

Pre-drilled rectangular copper bar with stand-off insulators, minimum 0.25 in [6.3 mm] thick x 4 in [100 mm] high in cross-section, length as shown on drawings, with 0.281 in [7.1 mm] holes spaced 1.125 in [28 mm] apart.

PART 3 - EXECUTION

3.1 GENERAL

- A. Ground in accordance with the NEC, as shown on drawings, and as specified herein.
- B. Equipment Ground: A green ground wire shall be installed in all raceways.
- C. System Grounding:
 - Secondary service neutrals: Ground at the supply side of the secondary disconnecting means and at the related transformers.
 - Separately derived systems (transformers downstream from the service entrance): Ground the secondary neutral.
- D. Equipment Grounding: Metallic structures, including ductwork and building steel, enclosures, raceways, junction boxes, outlet boxes, cabinets, machine frames, and other conductive items in close proximity with electrical circuits, shall be bonded and grounded.
- E. Special Grounding: For patient care area electrical power system grounding, conform to NFPA 99 and NEC.

3.2 INACCESSIBLE GROUNDING CONNECTIONS

Make grounding connections, which are normally buried or otherwise inaccessible (except connections for which access for periodic testing is required), by exothermic weld.

3.3 MEDIUM VOLTAGE EQUIPMENT AND CIRCUITS

Switchgear: Provide a bare grounding electrode conductor from the switchgear ground bus to the grounding electrode system.

Duct Banks and Manholes: Provide an insulated equipment grounding conductor in each duct containing medium voltage conductors, sized per NEC except that minimum size shall be 2 AWG [25 mm²]. Bond the equipment grounding conductors to the switchgear ground bus, to all manhole hardware and ground rods, to the cable shielding grounding provisions of medium-voltage cable splices and terminations, and to equipment enclosures.

Pad-Mounted Transformers:

Provide a driven ground rod and bond with a grounding electrode conductor to the transformer grounding pad.

Ground the secondary neutral.

3.4 SECONDARY VOLTAGE EQUIPMENT AND CIRCUITS

- A. Main Bonding Jumper: Bond the secondary service neutral to the ground bus in the service equipment.

- B. Metallic Piping, Building Steel, and Supplemental Electrode(s):
Provide a grounding electrode conductor sized per NEC between the service equipment ground bus and all metallic water pipe systems, building steel, and supplemental or made electrodes. Provide jumper insulating joints in the metallic piping. All connections to electrodes shall be made with fittings that conform to UL 467. Provide a supplemental ground electrode and bond to the grounding electrode system.
- C. Service Disconnect (Separate Individual Enclosure): Provide a ground bar bolted to the enclosure with lugs for connecting the various grounding conductors.
- D. Switchboards and Panelboards:
Connect the various feeder equipment grounding conductors to the ground bus in the enclosure with suitable pressure connectors. For service entrance equipment, connect the grounding electrode conductor to the ground bus.
Provide ground bars, bolted to the housing, with sufficient lugs to terminate the equipment grounding conductors.
Connect metallic conduits that terminate without mechanical connection to the housing, by grounding bushings and grounding conductor to the equipment ground bus.
- E. Transformers:
Exterior: Exterior transformers supplying interior service equipment shall have the neutral grounded at the transformer secondary.
Provide a grounding electrode at the transformer.
Separately derived systems (transformers downstream from service equipment): Ground the secondary neutral at the transformer. Provide a grounding electrode conductor from the transformer to the nearest component of the grounding electrode system.
- F. Ground lighting fixtures to the green grounding conductor of the wiring system.

3.5 RACEWAY

- A. Conduit Systems:
Ground all metallic conduit systems. All metallic conduit systems shall contain an equipment grounding conductor.
Non-metallic conduit systems, except non-metallic feeder conduits that carry a grounded conductor from exterior transformers to

interior or building-mounted service entrance equipment, shall contain an equipment grounding conductor.

Conduit that only contains a grounding conductor, and is provided for its mechanical protection, shall be bonded to that conductor at the entrance and exit from the conduit.

Metallic conduits which terminate without mechanical connection to an electrical equipment housing by means of locknut and bushings or adapters, shall be provided with grounding bushings. Connect bushings with a bare grounding conductor to the equipment ground bus.

B. Feeders and Branch Circuits: Install equipment grounding conductors with all feeders and power and lighting branch circuits.

C. Boxes, Cabinets, Enclosures, and Panelboards:

Bond the equipment grounding conductor to each pullbox, junction box, outlet box, device box, cabinets, and other enclosures through which the conductor passes (except for special grounding systems for intensive care units and other critical units shown).

Provide lugs in each box and enclosure for equipment grounding conductor termination.

D. Wireway Systems:

Bond the metallic structures of wireway to provide 100% electrical continuity throughout the wireway system, by connecting a No. 6 AWG [16 mm²] bonding jumper at all intermediate metallic enclosures and across all section junctions.

Install insulated No. 6 AWG [16 mm²] bonding jumpers between the wireway system, bonded as required above, and the closest building ground at each end and approximately every 50 ft [16 M].

Use insulated No. 6 AWG [16 mm²] bonding jumpers to ground or bond metallic wireway at each end for all intermediate metallic enclosures and across all section junctions.

Use insulated No. 6 AWG [16 mm²] bonding jumpers to ground cable tray to column-mounted building ground plates (pads) at each end and approximately every 49 ft [15 M].

E. Receptacles shall not be grounded through their mounting screws. Ground receptacles with a jumper from the receptacle green ground terminal to the device box ground screw and a jumper to the branch circuit equipment grounding conductor.

Ground lighting fixtures to the equipment grounding conductor of the wiring system when the green ground is provided; otherwise, ground the fixtures through the conduit systems. Fixtures connected with flexible conduit shall have a green ground wire included with the power wires from the fixture through the flexible conduit to the first outlet box. Fixed electrical appliances and equipment shall be provided with a ground lug for termination of the equipment grounding conductor.

Panelboard Bonding in Patient Care Areas: The equipment grounding terminal buses of the normal and essential branch circuit panel boards serving the same individual patient vicinity shall be bonded together with an insulated continuous copper conductor not less than No. 10 AWG [16 mm²]. These conductors shall be installed in rigid metal conduit.

3.6 CORROSION INHIBITORS

When making ground and ground bonding connections, apply a corrosion inhibitor to all contact surfaces. Use corrosion inhibitor appropriate for protecting a connection between the metals used.

3.7 CONDUCTIVE PIPING

Bond all conductive piping systems, interior and exterior, to the grounding electrode system. Bonding connections shall be made as close as practical to the equipment ground bus.

In operating rooms and at intensive care and coronary care type beds, bond the gases and suction piping at the outlets directly to the room or patient ground bus.

3.8 ELECTRICAL ROOM GROUNDING

Building Earth Ground Busbars: Provide ground busbar and mounting hardware at each electrical room and connect to pigtail extensions of the building grounding ring.

3.9 EXTERIOR LIGHT POLES

Provide 20 ft [6.1 M] of No. 4 bare copper coiled at bottom of pole base excavation prior to pour, plus additional unspliced length in and above foundation as required to reach pole ground stud.

3.10 GROUND RESISTANCE

A. Grounding system resistance to ground shall not exceed 5 ohms. Make any modifications or additions to the grounding electrode system necessary for compliance without additional cost to the Government. Final tests shall ensure that this requirement is met.

Resistance of the grounding electrode system shall be measured using a four-terminal fall-of-potential method as defined in IEEE 81. Ground resistance measurements shall be made before the electrical distribution system is energized and shall be made in normally dry conditions not fewer than 48 hours after the last rainfall. Resistance measurements of separate grounding electrode systems shall be made before the systems are bonded together below grade. The combined resistance of separate systems may be used to meet the required resistance, but the specified number of electrodes must still be provided.

Below-grade connections shall be visually inspected by the COTR prior to backfilling. The contractor shall notify the COTR 24 hours before the connections are ready for inspection.

3.12 GROUND ROD INSTALLATION

For outdoor installations, drive each rod vertically in the earth, until top of rod is 24 in [609 mm] below final grade.

For indoor installations, leave 4 in [100 mm] of rod exposed.

Where permanently concealed ground connections are required, make the connections by the exothermic process, to form solid metal joints. Make accessible ground connections with mechanical pressure-type ground connectors.

Where rock prevents the driving of vertical ground rods, install angled ground rods or grounding electrodes in horizontal trenches to achieve the specified resistance.

- - - E N D - - -

SECTION 26 05 33
RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 DESCRIPTION

This section specifies the furnishing, installation, and connection of conduit, fittings, and boxes, to form complete, coordinated, grounded raceway systems. Raceways are required for all wiring unless shown or specified otherwise.

Definitions: The term conduit, as used in this specification, shall mean any or all of the raceway types specified.

1.2 RELATED WORK

Section 06 10 00, ROUGH CARPENTRY: Mounting board for telephone closets.

Section 07 60 00, FLASHING AND SHEET METAL: Fabrications for the deflection of water away from the building envelope at penetrations.

Section 07 84 00, FIRESTOPPING: Sealing around penetrations to maintain the integrity of fire rated construction.

Section 07 92 00, JOINT SEALANTS: Sealing around conduit penetrations through the building envelope to prevent moisture migration into the building.

Section 09 91 00, PAINTING: Identification and painting of conduit and other devices.

Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS: General electrical requirements and items that are common to more than one section of Division 26.

Section 26 05 26, GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS: Requirements for personnel safety and to provide a low impedance path for possible ground fault currents.

Section 26 05 41, UNDERGROUND ELECTRICAL CONSTRUCTION: Underground conduits.

Section 31 20 00, EARTH MOVING: Bedding of conduits.

1.3 QUALITY ASSURANCE

Refer to Paragraph, QUALIFICATIONS, in Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS.

1.4 SUBMITTALS

In accordance with Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS, submit the following:

Manufacturer's Literature and Data: Showing each cable type and rating.

The specific item proposed and its area of application shall be identified on the catalog cuts.

Shop Drawings:

Size and location of main feeders.

Size and location of panels and pull-boxes.

Layout of required conduit penetrations through structural elements.

C. Certifications:

1. Two weeks prior to the final inspection, submit four copies of the following certifications to the COTR:

Certification by the manufacturer that the material conforms to the requirements of the drawings and specifications.

Certification by the contractor that the material has been properly installed.

1.5 APPLICABLE PUBLICATIONS

Publications listed below (including amendments, addenda, revisions, supplements, and errata) form a part of this specification to the extent referenced. Publications are referenced in the text by designation only.

American National Standards Institute (ANSI):

C80.1-05 Electrical Rigid Steel Conduit

C80.3-05 Steel Electrical Metal Tubing

C80.6-05 Electrical Intermediate Metal Conduit

National Fire Protection Association (NFPA):

70-08 National Electrical Code (NEC)

Underwriters Laboratories, Inc. (UL):

1-05 Flexible Metal Conduit

5-04 Surface Metal Raceway and Fittings

6-07 Electrical Rigid Metal Conduit - Steel

50-95 Enclosures for Electrical Equipment

360-093 Liquid-Tight Flexible Steel Conduit

467-07 Grounding and Bonding Equipment

514A-04 Metallic Outlet Boxes

514B-04 Conduit, Tubing, and Cable Fittings

514C-96 Nonmetallic Outlet Boxes, Flush-Device Boxes and Covers

651-05 Schedule 40 and 80 Rigid PVC Conduit and Fittings

651A-00 Type EB and A Rigid PVC Conduit and HDPE Conduit

797-07 Electrical Metallic Tubing

1242-06 Electrical Intermediate Metal Conduit - Steel

National Electrical Manufacturers Association (NEMA):

TC-2-03 Electrical Polyvinyl Chloride (PVC) Tubing and Conduit

TC-3-04 PVC Fittings for Use with Rigid PVC Conduit and Tubing

FB1-07 Fittings, Cast Metal Boxes and Conduit Bodies
for Conduit, Electrical Metallic Tubing and
Cable

PART 2 - PRODUCTS

2.1 MATERIAL

- A. Conduit Size: In accordance with the NEC, but not less than 0.75 in [19 mm] unless otherwise shown. Where permitted by the NEC, 0.75 in [19 mm] flexible conduit may be used for tap connections to recessed lighting fixtures.
- B. Conduit:
- Rigid steel: Shall conform to UL 6 and ANSI C80.1.
Aluminum conduit not allowed.
Rigid intermediate steel conduit (IMC): Shall conform to UL 1242 and ANSI C80.6.
Electrical metallic tubing (EMT): Shall conform to UL 797 and ANSI C80.3. Maximum size not to exceed 4 in [105 mm] and shall be permitted only with cable rated 600 V or less.
Flexible galvanized steel conduit: Shall conform to UL 1.
Liquid-tight flexible metal conduit: Shall conform to UL 360.
Direct burial plastic conduit: Shall conform to UL 651 and UL 651A, heavy wall PVC or high density polyethylene (PE).
Surface metal raceway: Shall conform to UL 5.
- C. Conduit Fittings:
1. Rigid steel and IMC conduit fittings:
Fittings shall meet the requirements of UL 514B and NEMA FB1.
Standard threaded couplings, locknuts, bushings, conduit bodies, and elbows: Only steel or malleable iron materials are acceptable.
Integral retractable type IMC couplings are also acceptable.
Locknuts: Bonding type with sharp edges for digging into the metal wall of an enclosure.
Bushings: Metallic insulating type, consisting of an insulating insert, molded or locked into the metallic body of the fitting.
Bushings made entirely of metal or nonmetallic material are not permitted.
2. Electrical metallic tubing fittings:
Fittings and conduit bodies shall meet the requirements of UL 514B, ANSI C80.3, and NEMA FB1.
Only steel or malleable iron materials are acceptable.
Compression couplings and connectors: Concrete-tight and rain-tight, with connectors having insulated throats.
Indent-type connectors or couplings are prohibited.

- e. Die-cast or pressure-cast zinc-alloy fittings or fittings made of "pot metal" are prohibited.
- 4. Flexible steel conduit fittings:
 - Conform to UL 514B. Only steel or malleable iron materials are acceptable.
 - Clamp-type, with insulated throat.
- 5. Liquid-tight flexible metal conduit fittings:
 - Fittings shall meet the requirements of UL 514B and NEMA FB1.
 - Only steel or malleable iron materials are acceptable.
 - Fittings must incorporate a threaded grounding cone, a steel or plastic compression ring, and a gland for tightening. Connectors shall have insulated throats.
- 6. Direct burial plastic conduit fittings:
 - Fittings shall meet the requirements of UL 514C and NEMA TC3.
- 7. Surface metal raceway fittings: As recommended by the raceway manufacturer. Include couplings, offsets, elbows, expansion joints, adapters, hold-down straps, end caps, conduit entry fittings, accessories, and other fittings as required for complete system.
- 8. Expansion and deflection couplings:
 - a. Conform to UL 467 and UL 514B.
 - b. Accommodate a 0.75 in [19 mm] deflection, expansion, or contraction in any direction, and allow 30 degree angular deflections.
 - c. Include internal flexible metal braid, sized to guarantee conduit ground continuity and a low-impedance path for fault currents, in accordance with UL 467 and the NEC tables for equipment grounding conductors.
 - d. Jacket: Flexible, corrosion-resistant, watertight, moisture and heat-resistant molded rubber material with stainless steel jacket clamps.
- D. Conduit Supports:
 - Parts and hardware: Zinc-coat or provide equivalent corrosion protection.
 - Individual Conduit Hangers: Designed for the purpose, having a pre-assembled closure bolt and nut, and provisions for receiving a hanger rod.
 - Multiple conduit (trapeze) hangers: Not less than 1.5 x 1.5 in [38 mm x 38 mm], 12-gauge steel, cold-formed, lipped channels; with not less than 0.375 in [9 mm] diameter steel hanger rods.
 - Solid Masonry and Concrete Anchors: Self-drilling expansion shields, or machine bolt expansion.

E. Outlet, Junction, and Pull Boxes:

UL-50 and UL-514A.

Cast metal where required by the NEC or shown, and equipped with rustproof boxes.

Sheet metal boxes: Galvanized steel, except where otherwise shown.

Flush-mounted wall or ceiling boxes shall be installed with raised covers so that the front face of raised cover is flush with the wall. Surface-mounted wall or ceiling boxes shall be installed with surface-style flat or raised covers.

F. Wireways: Equip with hinged covers, except where removable covers are shown. Include couplings, offsets, elbows, expansion joints, adapters, hold-down straps, end caps, and other fittings to match and mate with wireways as required for a complete system.

PART 3 - EXECUTION

3.1 PENETRATIONS

A. Cutting or Holes:

Cut holes in advance where they should be placed in the structural elements, such as ribs or beams. Obtain the approval of the COTR prior to drilling through structural elements.

Cut holes through concrete and masonry in new and existing structures with a diamond core drill or concrete saw. Pneumatic hammers, impact electric, hand, or manual hammer-type drills are not allowed, except where permitted by the COTR as required by limited working space.

B. Firestop: Where conduits, wireways, and other electrical raceways pass through fire partitions, fire walls, smoke partitions, or floors, install a fire stop that provides an effective barrier against the spread of fire, smoke and gases as specified in Section 07 84 00, FIRESTOPPING.

C. Waterproofing: At floor, exterior wall, and roof conduit penetrations, completely seal clearances around the conduit and make watertight, as specified in Section 07 92 00, JOINT SEALANTS.

3.2 INSTALLATION, GENERAL

In accordance with UL, NEC, as shown, and as specified herein.

Essential (Emergency) raceway systems shall be entirely independent of other raceway systems, except where shown on drawings.

Install conduit as follows:

In complete mechanically and electrically continuous runs before pulling in cables or wires.

Unless otherwise indicated on the drawings or specified herein, installation of all conduits shall be concealed within finished walls, floors, and ceilings.

Flattened, dented, or deformed conduit is not permitted. Remove and replace the damaged conduits with new undamaged material. Assure conduit installation does not encroach into the ceiling height head room, walkways, or doorways.

Cut square, ream, remove burrs, and draw up tight.

Independently support conduit at 8 ft [2.4 M] on centers. Do not use other supports, i.e., suspended ceilings, suspended ceiling supporting members, lighting fixtures, conduits, mechanical piping, or mechanical ducts.

Support within 12 in [300 mm] of changes of direction, and within 12 in [300 mm] of each enclosure to which connected.

Close ends of empty conduit with plugs or caps at the rough-in stage until wires are pulled in, to prevent entry of debris.

Conduit installations under fume and vent hoods are prohibited.

Secure conduits to cabinets, junction boxes, pull-boxes, and outlet boxes with bonding type locknuts. For rigid and IMC conduit installations, provide a locknut on the inside of the enclosure, made up wrench tight. Do not make conduit connections to junction box covers.

Flashing of penetrations of the roof membrane is specified in Section 07 60 00, FLASHING AND SHEET METAL.

Conduit bodies shall only be used for changes in direction, and shall not contain splices.

D. Conduit Bends:

Make bends with standard conduit bending machines.

Conduit hickey may be used for slight offsets and for straightening stubbed out conduits.

Bending of conduits with a pipe tee or vise is prohibited.

E. Layout and Homeruns:

Install conduit with wiring, including homeruns, as developed through coordination meeting with COTR.

Deviations: Make only where necessary to avoid interferences and only after drawings showing the proposed deviations have been submitted approved by the COTR. 3.3 CONCEALED WORK INSTALLATION A.

In Concrete:

Conduit: Rigid steel, IMC, or EMT. Do not install EMT in concrete slabs that are in contact with soil, gravel, or vapor barriers.

Align and run conduit in direct lines.

Install conduit through concrete beams only: a.

Where shown on the structural drawings.

- b. As approved by the COTR prior to construction, and after submittal of drawing showing location, size, and position of each penetration.
- 4. Installation of conduit in concrete that is less than 3 in [75 mm] thick is prohibited.
Conduit outside diameter larger than one-third of the slab thickness is prohibited.
Space between conduits in slabs: Approximately six conduit diameters apart, and one conduit diameter at conduit crossings.
Install conduits approximately in the center of the slab so that there will be a minimum of 0.75 in [19 mm] of concrete around the conduits.
- 5. Make couplings and connections watertight. Use thread compounds that are UL approved conductive type to ensure low resistance ground continuity through the conduits. Tightening setscrews with pliers is prohibited.
- B. Above Furred or Suspended Ceilings and in Walls:
Conduit for conductors 600 V and below: Rigid steel, IMC, or EMT.
Mixing different types of conduits indiscriminately in the same system is prohibited.
Align and run conduit parallel or perpendicular to the building lines.
Connect recessed lighting fixtures to conduit runs with maximum 6 ft [1.8 M] of flexible metal conduit extending from a junction box to the fixture.
Tightening setscrews with pliers is prohibited.

3.4 EXPOSED WORK INSTALLATION

- Unless otherwise indicated on the drawings, exposed conduit is only permitted in mechanical and electrical rooms.
- Conduit for Conductors 600 V and Below: Rigid steel, IMC, or EMT. Mixing different types of conduits indiscriminately in the system is prohibited.
- Align and run conduit parallel or perpendicular to the building lines. Install horizontal runs close to the ceiling or beams and secure with conduit straps.
- Support horizontal or vertical runs at not over 8 ft [2.4 M] intervals.
- Surface metal raceways: Use only where shown.
- Painting:
- Paint exposed conduit as specified in Section 09 91 00, PAINTING.
 - Paint all conduits containing cables rated over 600 V safety orange.
 - Refer to Section 09 91 00, PAINTING for preparation, paint type, and

exact color. In addition, paint legends, using 2 in [50 mm] high black numerals and letters, showing the cable voltage rating.

Provide legends where conduits pass through walls and floors and at maximum 20 ft [6 M] intervals in between.

3.5 DIRECT BURIAL INSTALLATION

Refer to Section 26 05 41, UNDERGROUND ELECTRICAL CONSTRUCTION.

3.6 HAZARDOUS LOCATIONS

Use rigid steel conduit only, notwithstanding requirements otherwise specified in this or other sections of these specifications.

Install UL approved sealing fittings that prevent passage of explosive vapors in hazardous areas equipped with explosion-proof lighting fixtures, switches, and receptacles, as required by the NEC.

3.7 WET OR DAMP LOCATIONS

Unless otherwise shown, use conduits of rigid steel or IMC.

Provide sealing fittings to prevent passage of water vapor where conduits pass from warm to cold locations, i.e., refrigerated spaces, constant-temperature rooms, air-conditioned spaces, building exterior walls, roofs, or similar spaces.

Unless otherwise shown, use rigid steel or IMC conduit within 5 ft [1.5 M] of the exterior and below concrete building slabs in contact with soil, gravel, or vapor barriers. Conduit shall be half-lapped with 10 mil PVC tape before installation. After installation, completely recoat or retape any damaged areas of coating.

3.8 MOTORS AND VIBRATING EQUIPMENT

Use flexible metal conduit for connections to motors and other electrical equipment subject to movement, vibration, misalignment, cramped quarters, or noise transmission.

Use liquid-tight flexible metal conduit for installation in exterior locations, moisture or humidity laden atmosphere, corrosive atmosphere, water or spray wash-down operations, inside airstream of HVAC units, and locations subject to seepage or dripping of oil, grease, or water. Provide a green equipment grounding conductor with flexible metal conduit.

3.9 EXPANSION JOINTS

Conduits 3 in [75 mm] and larger that are secured to the building structure on opposite sides of a building expansion joint require expansion and deflection couplings. Install the couplings in accordance with the manufacturer's recommendations.

Provide conduits smaller than 3 in [75 mm] with junction boxes on both sides of the expansion joint. Connect conduits to junction boxes with

sufficient slack of flexible conduit to produce 5 in [125 mm] vertical drop midway between the ends. Flexible conduit shall have a bonding jumper installed. In lieu of this flexible conduit, expansion and deflection couplings as specified above for conduits 15 in [375 mm] and larger are acceptable.

Install expansion and deflection couplings where shown.

Seismic Areas: In seismic areas, provide conduits rigidly secured to the building structure on opposite sides of a building expansion joint with junction boxes on both sides of the joint. Connect conduits to junction boxes with 15 in [375 mm] of slack flexible conduit. Flexible conduit shall have a copper green ground bonding jumper installed.

3.10 CONDUIT SUPPORTS, INSTALLATION

- A. Safe working load shall not exceed one-quarter of proof test load of fastening devices.
- B. Use pipe straps or individual conduit hangers for supporting individual conduits.
- C. Support multiple conduit runs with trapeze hangers. Use trapeze hangers that are designed to support a load equal to or greater than the sum of the weights of the conduits, wires, hanger itself, and 200 lbs [90 kg]. Attach each conduit with U-bolts or other approved fasteners.
- D. Support conduit independently of junction boxes, pull-boxes, fixtures, suspended ceiling T-bars, angle supports, and similar items.
- E. Fasteners and Supports in Solid Masonry and Concrete:
New Construction: Use steel or malleable iron concrete inserts set in place prior to placing the concrete.
Existing Construction:
Steel expansion anchors not less than 0.25 in [6 mm] bolt size and not less than 1.125 in [28 mm] embedment.
Power set fasteners not less than 0.25 in [6 mm] diameter with depth of penetration not less than 3 in [75 mm].
Use vibration and shock-resistant anchors and fasteners for attaching to concrete ceilings.
- F. Hollow Masonry: Toggle bolts.
- G. Bolts supported only by plaster or gypsum wallboard are not acceptable.
- H. Metal Structures: Use machine screw fasteners or other devices specifically designed and approved for the application.
- I. Attachment by wood plugs, rawl plug, plastic, lead or soft metal anchors, or wood blocking and bolts supported only by plaster is prohibited.
- J. Chain, wire, or perforated strap shall not be used to support or fasten conduit.

Spring steel type supports or fasteners are prohibited for all uses except horizontal and vertical supports/fasteners within walls.

Vertical Supports: Vertical conduit runs shall have riser clamps and supports in accordance with the NEC and as shown. Provide supports for cable and wire with fittings that include internal wedges and retaining collars.

3.11 BOX INSTALLATION

A. Boxes for Concealed Conduits:

Flush-mounted.

Provide raised covers for boxes to suit the wall or ceiling, construction, and finish.

B. In addition to boxes shown, install additional boxes where needed to prevent damage to cables and wires during pulling-in operations.

C. Remove only knockouts as required and plug unused openings. Use threaded plugs for cast metal boxes and snap-in metal covers for sheet metal boxes.

D. Outlet boxes mounted back-to-back in the same wall are prohibited. A minimum 24 in [600 mm] center-to-center lateral spacing shall be maintained between boxes.

E. Minimum size of outlet boxes for ground fault interrupter (GFI) receptacles is 4 in [100 mm] square x 2.125 in [55 mm] deep, with device covers for the wall material and thickness involved.

F. Stencil or install phenolic nameplates on covers of the boxes identified on riser diagrams; for example "SIG-FA JB No. 1."

G. On all branch circuit junction box covers, identify the circuits with black marker.

H. For boxes installed in metal stud construction, use rigid support metal bar hangers or metal bar fasteners attached to two studs. Screwing boxes directly to joists or studs is not acceptable.

I. Label all covers of electrical boxes with the panel name and circuits contained in the box. For example: L2E 15, 17, 19.

- - - E N D - - -

SECTION 26 05 41
UNDERGROUND ELECTRICAL CONSTRUCTION

PART 1 - GENERAL

1.1 DESCRIPTION

This section specifies the furnishing, installation, and connection of precast manholes and pullboxes with ducts to form a complete underground raceway system.

"Duct" and "conduit," and "rigid metal conduit" and "rigid steel conduit" are used interchangeably in this specification.

1.2 RELATED WORK

Section 07 92 00, JOINT SEALANTS: Sealing of conduit penetrations.

Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS: General electrical requirements and items that are common to more than one section of Division 26.

Section 26 05 26, GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS:

Requirements for personnel safety and to provide a low impedance path for possible ground fault currents.

Section 26 05 33, RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS: Conduits, fittings and boxes for raceway systems.

Section 31 20 11, EARTH MOVING (SHORT FORM): Trenching, backfill and compaction.

1.3 QUALITY ASSURANCE

Refer to Paragraph, QUALIFICATIONS, in Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS.

Coordinate layout and installation of ducts, manholes, pullboxes, and pull-boxes with final arrangement of other utilities, site grading, and surface features, as determined in the field.

1.4 SUBMITTALS

Submit in accordance with Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS.

Shop Drawings:

1. Clearly present sufficient information to determine compliance with drawings and specifications.

Certifications: Two weeks prior to the final inspection, submit four copies of the following certifications to the COTR: 1. Certification by the manufacturer that the materials conform to the requirements of the drawings and specifications.

2. Certification by the contractor that the materials have been properly installed, connected, and tested.

1.5 APPLICABLE PUBLICATIONS

Publications listed below (including amendments, addenda, revisions, supplements, and errata) form a part of this specification to the extent referenced. Publications are referenced in the text by designation only.

American Concrete Institute (ACI):

- Building Code Requirements for Structural Concrete
318/318M-05 Building Code Requirements for Structural
Concrete & Commentary
- SP-66-04ACI Detailing Manual

American National Standards Institute (ANSI):

- 77-07Underground Enclosure Integrity

American Society for Testing and Materials (ASTM):

- C478-09 Standard Specification for Precast Reinforced
Concrete Manhole Sections
- C858-09Underground Precast Concrete Utility Structures
- C990-09Standard Specification for Joints for Concrete
Pipe, Manholes and Precast Box Sections
Using Preformed Flexible Joint Sealants.

Institute of Electrical and Electronic Engineers (IEEE):

- C2-07National Electrical Safety Code

National Electrical Manufacturers Association (NEMA):

- TC 2-03 Electrical Polyvinyl Chloride (PVC) Tubing And
Conduit
- TC 3-2004 PVC Fittings for Use With Rigid PVC Conduit And
Tubing
- TC 6 & 8 2003 PVC Plastic Utilities Duct For Underground
Installations
- TC 9-2004Fittings For PVC Plastic Utilities Duct For
Underground Installation

National Fire Protection Association (NFPA):

- 70-08 National Electrical Code (NEC)

Underwriters Laboratories, Inc. (UL):

- 6-07Electrical Rigid Metal Conduit-Steel
- 467-07Grounding and Bonding Equipment

- 651-05 Schedule 40 and 80 Rigid PVC Conduit and Fittings
- 651A-00 Type EB and A Rigid PVC Conduit and HDPE Conduit
- 651B-07 Continuous Length HDPE Conduit
- I. U.S. General Services Administration (GSA):
- A-A-60005-1998 Frames, Covers, Gratings, Steps, Sump and Catch Basin, Manhole

1.6 STORAGE

Lift and support pre-cast concrete structures only at designated lifting or supporting points.

PART 2 - PRODUCTS

2.2 PULLBOXES

- A. General: Size as indicated on drawings. Provide pullboxes with weatherproof, non-skid covers with recessed hook eyes, secured with corrosion- and tamper-resistant hardware. Cover material shall be identical to pullbox material. Covers shall have molded lettering, ELECTRIC or SIGNAL as applicable. Pullboxes shall comply with the requirements of ANSI/SCTE 77 Tier 8, loading, or as required for vehicular traffic areas. Provide pulling irons, 0.875 in [22 mm] diameter galvanized steel bar with exposed triangular-shaped opening.

Polymer Concrete Pullboxes: Shall be molded of sand, aggregate, and polymer resin, and reinforced with steel, fiberglass, or both. Pullbox shall have open bottom.

Fiberglass Pullboxes: Shall be sheet-molded, fiberglass-reinforced, polyester resin enclosure joined to polymer concrete top ring or frame.

2.1. DUCTS

- A. Number and sizes shall be as shown on drawings.

- B. Ducts (concrete-encased):

1. Plastic Duct:

NEMA TC6 & 8 and TC9 plastic utilities duct, UL 651 and 651A Schedule 40 PVC.

Duct shall be suitable for use with 194• F [90• C] rated conductors.

2. Conduit Spacers: Prefabricated plastic.

- C. Ducts (direct-burial):

1. Plastic duct:

NEMA TC2 and TC3

UL 651, 651A, and 651B, Schedule 80 PVC.

Duct shall be suitable for use with 167• F [75• C] rated conductors.

2. Rigid metal conduit: UL6 and NEMA RN1 galvanized rigid steel, threaded type, half-lapped with 10 mil PVC tape.

2.2 GROUNDING

Rods: Per Section 26 05 26, GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS.

Ground Wire: Stranded bare copper 6 AWG [16 mm²] minimum.

2.3 WARNING TAPE

Standard 4-mil polyethylene 3 in [76 mm] wide detectable tape, red with black letters, imprinted with "CAUTION - BURIED ELECTRIC CABLE BELOW" or similar.

2.4 PULL ROPE FOR SPARE DUCTS

Plastic with 200 lb [890 N] minimum tensile strength.

PART 3 - EXECUTION**3.1 TRENCHING**

Refer to Section 31 20 11 EARTH MOVING (SHORT FORM) for trenching, backfilling, and compaction.

Before performing trenching work at existing facilities, the Ground Penetrating Radar Survey shall be carefully performed by certified technician to reveal all existing underground ducts, conduits, cables, and other utility systems.

Work with extreme care near existing ducts, conduits, cables, and other utilities to avoid damaging them.

Cut the trenches neatly and uniformly.

For Concrete-Encased Ducts:

After excavation of the trench, stakes shall be driven in the bottom of the trench at 4 ft [1.2 M] intervals to establish the grade and route of the duct bank.

Pitch the trenches uniformly toward manholes or both ways from high points between manholes for the required duct line drainage. Avoid pitching the ducts toward buildings wherever possible.

The walls of the trench may be used to form the side walls of the duct bank, provided that the soil is self-supporting and that

concrete envelope can be poured without soil inclusions. Forms are required where the soil is not self-supporting.

4. After the concrete-encased duct has sufficiently cured, the trench shall be backfilled to grade with earth, and appropriate warning tape installed.

F. Conduits to be installed under existing paved areas and roads that cannot be disturbed shall be jacked into place. Conduits shall be heavy wall rigid steel.

3.2 DUCT INSTALLATION

A. General Requirements:

Ducts shall be in accordance with the NEC and IEEE C2, as shown on the drawings, and as specified.

Slope ducts to drain towards manholes and pullboxes, and away from building and equipment entrances. Pitch not less than 4 in [100 mm] in 100 ft [30 M].

Underground conduit stub-ups and sweeps to equipment inside of buildings shall be taped galvanized rigid steel, and shall extend a minimum of 5 ft [1.5 M] outside the building foundation. Tops of conduits below building slab shall be minimum 24 in [610 mm] below bottom of slab.

Stub-ups, sweeps, and risers to equipment mounted on outdoor concrete slabs shall be taped galvanized rigid steel, and shall extend a minimum of 5 ft [1.5 M] away from the edge of slab.

Install insulated grounding bushings on the terminations.

Radius for turns of direction shall be sufficient to accomplish pulls without damage. Minimum radius shall be six times conduit diameter. Use manufactured long sweep bends.

Additional burial depth shall be required in order to accomplish NEC-required minimum bend radius of ducts.

All multiple conduit runs shall have conduit spacers. Spacers shall securely support and maintain uniform spacing of the duct assembly a minimum of 3 in [75 mm] above the bottom of the trench during the concrete pour. Spacer spacing shall not exceed 5 ft [1.5 M]. Secure spacers to ducts and earth to prevent floating during concrete pour. Provide nonferrous tie wires to prevent displacement of the ducts during pouring of concrete. Tie wires shall not act as substitute for spacers.

9. Duct lines shall be installed no less than 12 in [300 mm] from other utility systems, such as water, sewer, and chilled water.
 10. Clearances between individual ducts:
 - For like services, not less than 3 in [75 mm].
 - For power and signal services, not less than 6 in [150 mm].
 11. Duct lines shall terminate at window openings in manhole walls as shown on the drawings. All ducts shall be fitted with end bells.
 12. Couple the ducts with proper couplings. Stagger couplings in rows and layers to ensure maximum strength and rigidity of the duct bank.
 13. Keep ducts clean of earth, sand, or gravel, and seal with tapered plugs upon completion of each portion of the work.
 14. Seal conduits, including spare conduits, at building entrances and at outdoor equipment terminations with a suitable compound to prevent entrance of moisture and gases.
- B. Concrete-Encased Ducts and Conduits:
1. Install concrete-encased ducts for medium-voltage systems, low-voltage systems, and signal systems, unless otherwise shown on the drawings.
 2. Duct lines shall consist of single or multiple duct assemblies encased in concrete. Ducts shall be uniform in size and material throughout the installation.
 3. Tops of concrete-encased ducts shall be:
 - Not less than 24 in [600 mm] and not less than shown on the drawings, below finished grade.
 - Not less than 30 in [750 mm] and not less than shown on the drawings, below roads and other paved surfaces.Conduits crossing under grade slab construction joints shall be installed a minimum of 4 ft [1.2 M] below slab.
 4. Extend the concrete envelope encasing the ducts not less than 3 in [75 mm] beyond the outside walls of the outer ducts and conduits.
 5. Within 10 ft [3 M] of building manhole and pullbox wall penetrations, install reinforcing steel bars at the top and bottom of each concrete envelope to provide protection against vertical shearing.
 6. Install reinforcing steel bars at the top and bottom of each concrete envelope of all ducts underneath roadways and parking areas.

Where new ducts, conduits, and concrete envelopes are to be joined to existing manholes, pullboxes, ducts, conduits, and concrete envelopes, make the joints with the proper fittings and fabricate the concrete envelopes to ensure smooth durable transitions.

Conduit joints in concrete may be placed side by side horizontally, but shall be staggered at least 6 in [150 mm] vertically.

Pour each run of concrete envelope between manholes or other terminations in one continuous pour. If more than one pour is necessary, terminate each pour in a vertical plane and install 0.75 in [19 mm] reinforcing rod dowels extending 18 in [450 mm] into concrete on both sides of joint near corners of envelope.

Pour concrete so that open spaces are uniformly filled. Do not agitate with power equipment unless approved by COTR.

Duct Bank Markers:

Duct bank markers, where required and shown on plans, shall be located at the ends of duct banks except at manholes or pullboxes at approximately every 200 ft [60 M] along the duct run and at each change in direction of the duct run. Markers shall be placed 2 ft [0.6 M] to the right of the duct bank, facing the longitudinal axis of the run in the direction of the electrical load.

The letter "D" with two arrows shall be impressed or cast on top of the marker. One arrow shall be located below the letter and shall point toward the ducts. The second arrow shall be located adjacent to the letter and shall point in a direction parallel to the ducts. The letter and arrow adjacent to it shall each be approximately 2 in [75 mm] long. The letter and arrows shall be V-shaped, and shall have a width of stroke at least 0.75 in [6 mm] at the top and a depth of 0.25 in [6 mm].

In paved areas, the top of the duct markers shall be flush with the finished surface of the paving.

Where the duct bank changes direction, the arrow located adjacent to the letter shall be cast or impressed with an angle in the arrow equivalent to the angular change of the duct bank.// C. Concrete-Encased Duct and Conduit Identification: Place continuous strip of warning tape approximately 12 in [300 mm] above ducts or conduits before backfilling trenches. Warning tape shall be preprinted with proper identification.

- D. Spare Ducts and Conduits: Where spare ducts are shown, they shall have a nylon pull rope installed. They shall be capped at each end and labeled as to location of the other end.
- E. Duct and Conduit Cleaning:
Upon completion of the duct installation, a standard flexible mandrel shall be pulled through each duct to loosen particles of earth, sand, or foreign material left in the duct. The mandrel shall be not less than 12 in [3600 mm] long, and shall have a diameter not less than 0.5 in [13 mm] less than the inside diameter of the duct. A brush with stiff bristles shall then be pulled through each duct to remove the loosened particles. The diameter of the brush shall be the same as, or slightly larger than, the diameter of the duct. Mandrel pulls shall be witnessed by the COTR.
- F. Duct and Conduit Sealing: Seal the ducts and conduits at building entrances, and at outdoor terminations for equipment, with a suitable non-hardening compound to prevent the entrance of moisture and gases.
- G. Connections to Existing Manholes: For duct connections to existing manholes, break the structure wall out to the dimensions required and preserve the steel in the structure wall. Cut steel and extend into the duct bank envelope. Chip the perimeter surface of the duct bank opening to form a key or flared surface, providing a positive connection with the duct bank envelope.
- H. Connections to Existing Ducts: Where connections to existing duct banks are indicated, excavate around the duct banks as necessary. Cut off the ducts and remove loose concrete from inside before installing new ducts. Provide a reinforced-concrete collar, poured monolithically with the new ducts, to take the shear at the joint of the duct banks.
- I. Partially-Completed Duct Banks: During construction, wherever a construction joint is necessary in a duct bank, prevent debris such as mud and dirt from entering ducts by providing suitable conduit plugs. Fit concrete envelope of a partially completed duct bank with reinforcing steel extending a minimum of 2 ft [0.6 M] back into the envelope and a minimum of 2 ft [0.6 M] beyond the end of the envelope. Provide one No. 4 bar in each corner, 3 in [75 mm] from the edge of the envelope. Secure corner bars with two No. 3 ties, spaced approximately 12 in [300 mm] apart. Restrain reinforcing assembly from moving during pouring of concrete.

- - - E N D - - -

SECTION 26 12 19
PAD-MOUNTED, LIQUID-FILLED, MEDIUM-VOLTAGE TRANSFORMERS

PART 1 - GENERAL

1.1 DESCRIPTION

This section specifies the furnishing, installation, and connection of pad-mounted transformers.

Pad-mounted transformers shall be complete, outdoor type, continuous duty, integral assembly, grounded, tamper-resistant, and weatherproof, with liquid-immersed transformers.

1.2 RELATED WORK

Section 09 06 00, SCHEDULE FOR FINISHES: Finishes for electrical equipment.

Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS: General electrical requirements that are common to more than one section of Division 26.

Section 26 05 13, MEDIUM-VOLTAGE CABLES: Medium-voltage cables.

Section 26 05 26, GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS:

Requirements for personnel safety and to provide a low impedance path to ground for possible ground currents.

Section 26 05 41, UNDERGROUND ELECTRICAL CONSTRUCTION: Manholes, pull-boxes, and duct lines for underground raceway systems.

1.3 QUALITY ASSURANCE

Refer to Paragraph, QUALIFICATIONS, in Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS.

1.4 FACTORY TESTS

Transformers shall be thoroughly tested at the factory to ensure that there are no electrical or mechanical defects. Tests shall be conducted as per UL and ANSI Standards. Factory tests shall be certified. The following tests shall be performed:

Perform insulation-resistance tests, winding-to-winding and each winding-to-ground.

Perform turns-ratio tests at all tap positions.

1.5 SUBMITTALS

In accordance with Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS, submit the following:

Shop Drawings:

1. Clearly present sufficient information to determine compliance with drawings and specifications.

Include electrical ratings, nameplate data, impedance, outline drawing with dimensions and front, top, and side views, weight, mounting details, decibel rating, termination information, temperature rise, no-load and full-load losses, regulation, overcurrent protection, connection diagrams, and accessories. Complete nameplate data, including manufacturer's name and catalog number.

C. Manuals:

1. When submitting the shop drawings, submit companion copies of complete maintenance and operating manuals, including technical data sheets, wiring diagrams, and information for ordering replacement parts.

Identify terminals on wiring diagrams to facilitate installation, maintenance, and operation.

Indicate on wiring diagrams the internal wiring for each piece of equipment and interconnections between the pieces of equipment.

Approvals will be based on complete submissions of manuals, together with shop drawings.

2. Two weeks prior to the final inspection, submit four copies of the final up-dated maintenance and operation manuals to the COTR. Update the manual to include any information necessitated by shop drawing approval.

Show all terminal identification.

Include information for testing, repair, trouble-shooting, assembly, disassembly, and recommended maintenance intervals.

Provide a replacement parts list with current prices. Include a list of recommended spare parts, tools, and instruments for testing and maintenance purposes.

Furnish manuals in loose-leaf binder or manufacturer's standard binder.

D. Certifications:

Two weeks prior to the final inspection, submit four copies of the following certifications to the COTR:

Certification by the manufacturer that the materials conform to the requirements of the drawings and specifications.

Certification by the contractor that the materials have been properly installed, connected, and tested.

1.6 APPLICABLE PUBLICATIONS

Publications listed below (including amendments, addenda, revisions, supplements, and errata) form a part of this specification to the extent referenced. Publications are referenced in the text by designation only.

American Concrete Institute (ACI):

318-05 Building Code Requirements for Structural
Concrete

American National Standards Institute (ANSI):

C37.47-00 High Voltage Current-Limiting Type Distribution
Class Fuses and Fuse Disconnecting Switches

C57.12.00-00 General Requirements for Liquid-Immersed
Distribution, Power and Regulating Transformers

C57.12.25-90 Transformers-Pad-Mounted, Compartmental-Type,
Self Cooled, Single-Phase Distribution
Transformers with Separable Insulated High
Voltage Connectors; High Voltage, 34500 Grd
Y/19920 Volts and Below; Low-Voltage 240/120
Volts; 167 kVA and Smaller Requirements

C57.12.28-05 Pad-Mounted Equipment Enclosure Integrity

C57.12.29-99 Pad-Mounted Equipment - Enclosure Integrity for
Coastal Environments

C57.12.34-04 Pad-Mounted, Compartmental-Type, Self Cooled,
Three-Phase Distribution Transformers, 2500kVA
and Smaller - High Voltage 34500 Grd Y/19920
Volts and Below; Low-Voltage 480 Volts and Below

American Society for Testing and Materials (ASTM):

D3487-08 Standard Specification for Mineral Insulating
Oil Used in Electrical Apparatus

Institute of Electrical and Electronic Engineers (IEEE):

C2-07 National Electrical Safety Code

C62.11-99 Metal-Oxide Surge Arresters for Alternating
Current Power Circuits

48-09 Test Procedures and Requirements for Alternating
Current Cable Terminations Used on Shielded
Cables Having Laminated Insulation Rated 2.5kV
Through 765kV or Extruded Insulation Rated 2.5kV
Through 500kV

- 386-06Standard for Separable Insulated Connector
Systems for Power Distribution Systems
Above 600V
- 592-96 Standard for Exposed Semiconducting Shields on
High Voltage Cable Joints and Separable
Insulated Connectors

National Electrical Manufacturers Association (NEMA):

- C57.12.26-87 Pad-Mounted, Compartmental-Type, Self-Cooled,
Three-Phase Distribution Transformers for Use
with Separable Insulated High-Voltage
Connectors, High-Voltage, 34500 Grd Y/19920
Volts and Below; 2500 kVA and Smaller
- LA1-92Surge Arresters
- TP1-02Guide for Determining Energy Efficiency for
Distribution Transformers
- TR1-00Transformers, Regulators, and Reactors

National Fire Protection Association (NFPA):

- 70-08 National Electrical Code (NEC)

Underwriters Laboratories Inc. (UL):

- 467-07 Grounding and Bonding Equipment

PART 2 - PRODUCTS

2.1 EQUIPMENT, GENERAL

Equipment shall be in accordance with ANSI, ASTM, IEEE, NEMA, NFPA, UL, as shown on the drawings, and as specified herein. The transformer shall be assembled as an integral unit by a single manufacturer.

Ratings shall not be less than shown on the drawings.

Provide transformers designed to withstand the mechanical stresses caused by rough handling during shipment in addition to the electrical and mechanical stresses that may occur during operation.

Completely fabricate transformers at the factory so that only the external cable connections are required at the job site.

Thoroughly clean, phosphatize, and finish all the metal surfaces at the factory with a rust-resistant primer and dark green enamel finish coat, except where a different color is specified in Section 09 06 00, SCHEDULE FOR FINISHES. All surfaces of the unit that will be in contact with the concrete pad shall be treated with corrosion-resistant compounds and epoxy resin or a rubberized sealing compound.

2.2 COMPARTMENTS

A. Construction:

Enclosures shall be in accordance with ANSI C57.12.28.

The medium- and low-voltage compartments shall be separated with a steel barrier that extends the full height and depth of the compartments.

The compartments shall be constructed of sheet steel (gauge to meet ANSI requirements) with bracing, reinforcing gussets, and jig-welding to ensure rectangular rigidity.

Use cadmium or zinc plated bolts, nuts, and washers.

Sufficient space shall be provided for equipment, cabling, and terminations within the compartments.

Affix transformer nameplate permanently within the low-voltage compartment. Voltage and kVA rating, connection configuration, impedance, date of manufacture, and serial number shall be shown on the nameplate.

B. Doors:

Provide a separate door for each compartment with provisions for a single padlock to secure all doors. Provide each compartment door with open-position doorstops and corrosion-resistant tamperproof hinges welded in place. The medium-voltage compartment door shall be mechanically prevented from opening unless the low-voltage compartment door is open.

The secondary compartment door shall have a one-piece steel handle and incorporate three-point locking mechanisms.

2.3 BIL RATING

A. 15 kV class equipment shall have a minimum 95 kV BIL rating.

2.4 TRANSFORMER FUSE ASSEMBLY

A. The primary fuse assembly shall be load-break combination fuse and dry-well fuse holder rated for system voltage, rated for 10 load makes and 10 load breaks, with rated 200 amp load current at 75% power factor, 10,000 symmetrical A close-in on fault duty, and 95 kV BIL. The entire fuse assembly shall be removable through the use of hot stick.

The fuses shall be concealed, hot stick removable, 50,000 A symmetrical interrupting, non-expulsion, current-limiting primary distribution type, of the size and voltage class as shown on the drawings. The fuses shall operate within the fuse holder as a unit disconnecting means. Fuses shall be in accordance with ANSI C37.47.

Transformers shall not have internal "weak link" fuses that require transformer tank cover removal for replacement.

2.5 PRIMARY CONNECTIONS

- A. Primary connections shall be 200 A dead-front load break, 600 A dead break wells and inserts for cable sizes shown on the drawings.

2.6 MEDIUM-VOLTAGE SWITCH

The transformer primary disconnect switch for radial feeds shall be an oil-immersed, internal, gang-operated, load-interrupter type, rated 200 A, with a close-in on fault duty of 5,000 A symmetrical at voltage as shown on the drawings. The switch is to be a two-position, on-off, manual switch located in the medium-voltage compartment and hot-stick-operated.

1. Continuous current 200 A. A built-in switch with momentary current 10,000 A symmetrical (2 seconds). Make and latch 6,000 A symmetrical.

Where a loop-feed operation (sectionalizing switch) is shown on the drawings, provide a four-position configuration arrangement, oil-immersed, gang-operated, rotary, loadbreak switch. The switch mechanism shall be spring-loaded and the operation shall be independent of operator speed. The switch shall have the following ratings: 1.

Continuous current 200 A. A built-in switch with maximum phase-to-phase voltage 35 kV, maximum phase-to-ground voltage 21.1 kV.

Momentary 10,000 A for 10 cycles symmetrical.

2.7 MEDIUM-VOLTAGE TERMINATIONS

- A. Terminate the medium voltage cables in the primary compartment with loadbreak premolded rubber elbow connectors, suitable for submersible applications. Elbow connectors shall have a minimum of 0.125 in [3 mm] semi-conductive shield material covering the housing. The separable connector system shall include the loadbreak elbow, the bushing insert, and the bushing well. Separable connectors shall comply with the requirements of IEEE 386, and shall be interchangeable between suppliers. Loadbreak elbow and bushing insert shall be from the same manufacturer. Allow sufficient slack in medium-voltage cable, ground, and drain wires to permit elbow connectors to be moved to their respective parking stands. Elbow connectors shall be rated as follows:

Voltage: 15kV phase-to-phase.

Continuous current: 200 A RMS.

- B. Ground metallic cable shields with a device designed for that purpose, consisting of a solderless connector enclosed in watertight rubber housing covering the entire assembly.
- C. Provide insulated cable supports to relieve any strain imposed by cable weight or movement.

2.8 LOW-VOLTAGE EQUIPMENT

The low-voltage leads shall be brought out of the tank by epoxy pressure tight bushings, and shall be standard arrangement per ANSI.

Tin-plate the low-voltage neutral terminal and isolate from the transformer tank. Provide a removable ground strap sized in accordance with the NEC and connect between the neutral and ground pad.

2.9 TRANSFORMERS

- A. Transformers shall be three-phase, liquid-immersed, isolated winding, and self-cooled by natural convection.
- B. The kVA ratings shown on the drawings are for continuous duty without the use of cooling fans.
- C. Temperature rises shall not exceed the NEMA TR1 standards of 149• F [65• C] by resistance, and 180• F [80• C] hotspot at rated kVA.
- D. Transformer insulating material shall be mineral oil and shall be in accordance with ASTM D 3487.
- E. Transformer impedance shall be not less than 4.5% for sizes 150 kVA and larger. Impedance shall be as shown on the drawings.
- F. Sound levels shall conform to NEMA TR1 standards.
- G. Primary and Secondary Windings for Three-Phase Transformers:
 Primary and secondary windings shall be copper.
 Primary windings shall be delta-connected.
 Secondary windings shall be wye-connected, except where otherwise indicated on the drawings. Provide isolated neutral bushings for secondary wye-connected transformers.
 Secondary leads shall be brought out through pressure-tight epoxy bushings.
- H. Primary windings shall have four 2.55 full-capacity voltage taps; two taps above and two taps below rated voltage.
- I. Core and Coil Assemblies:
 Cores shall be grain-oriented, non-aging, and silicon steel to minimize losses.
 Core and coil assemblies shall be rigidly braced to withstand the stresses caused by rough handling during shipment, and stresses caused by any possible short-circuit currents.
 Coils shall be continuous-winding type without splices except for taps. Material shall be copper.
 Primary, secondary, and tap connections shall be brazed or pressure type.

J. The transformer tank, cover, and radiator gauge thickness shall not be less than that outlined in ANSI.

K. Accessories:

1. Provide standard NEMA features, accessories, and the following:

No-load tap changer (Provide warning sign).

Lifting, pulling, and jacking facilities.

Globe-type valve for oil filtering and draining, including sampling device.

Pressure relief valve.

Liquid level gauge and filling plug.

A grounding pad in the medium- and low-voltage compartments.

A diagrammatic nameplate and operating instructions enclosed by a transparent cover located in the low-voltage compartment.

Dial-type liquid thermometer with a maximum reading pointer and an external reset.

2. The accessories shall be made accessible within the compartments without disassembling trims and covers.

L. Transformers shall meet the minimum energy efficiency values per NEMA TP1:

KVA	(%)
75	98.1
112.5	98.3
150	99.0
225	99.0
300	99.0
500	99.1
750	99.2
1000	99.2
1500	99.3
2000	99.4
2500	99.4

2.10 CABLE FAULT INDICATORS (LOOP SYSTEM ONLY):

A. Provide each incoming and outgoing cable within the medium-voltage compartment with a single-phase cable fault indicator with in-rush restraint. Mount the indicator on the cable support member.

1. The sensor assembly shall have a split-core for easy installation over the incoming and outgoing cable. The core shall be laminated,

grain-oriented silicon steel, and encapsulated. Provide a clamp to secure the two coil halves around the cable.

2. Select the coil to the pick-up at the current setting shown on the drawings.

The coil setting shall be accurate to within 10% of the pick-up. The coil current-time curve shall coordinate with the primary current-limiting fuse.

- B. Upon restoration of the system to normal operating conditions, the cable fault indicator shall automatically reset to normal and be ready to operate.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install transformers as shown on the drawings, in accordance with the NEC, and as recommended by the manufacturer.

- B. Foundation:

Provide foundation of reinforced concrete, Type C, 21mPa (3000 psi minimum, 28 day compressive strength), complying with the ACI 318.

Locate the top of foundation pads 6 in [150 mm] above the adjacent finished grade, and integrated with transformer vault as indicated on the drawings. Refer to drawings for size, location, and structural steel reinforcing required.

Grade the adjacent terrain so that surface water will flow away from the foundation.

Anchor transformers with cadmium- or zinc-plated bolts, nuts, and washers. Bolts shall not be less than 0.5 in [12 mm] diameter.

- C. Grounding:

Ground each transformer in accordance with the requirements of the NEC. Install ground rods per the requirements of Section 26 05 26, GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS, to maintain a maximum resistance of 5 ohms to ground.

Connect the ground rod to the ground pads in the medium- and low-voltage compartments, and to the secondary and primary neutral with not less than a No. 2/0 AWG bare copper conductor.

Independently connect cable shield grounding devices ground wires to ground with sufficient slack to permit elbow connector operation. Connect elbow connectors with a No. 14 AWG bare copper drain wire from its grounding eye to the related cable shield grounding device ground wire. Do not connect drain wires in any manner that could

permit circulating currents, or cable fault currents, to pass through them.

3.2 ACCEPTANCE CHECKS AND TESTS

Perform tests in accordance with the manufacturer's recommendations.

Include the following visual and mechanical inspections.

Transformers:

Compare equipment nameplate data with specifications and approved shop drawings.

Inspect physical and mechanical condition. Check for damaged or cracked bushings and liquid leaks.

Verify that control and alarm settings on temperature indicators are as specified.

Inspect all field-installed bolted electrical connections, using the calibrated torque-wrench method to verify tightness of accessible bolted electrical connections, or perform thermographic survey after energization under load.

Verify correct liquid level in transformer tank.

Perform specific inspections and mechanical tests as recommended by manufacturer.

Verify correct equipment grounding per the requirements of Section 26 05 26, GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS.

Verify the presence of transformer surge arresters, if provided.

Verify that the tap-changer is set at specified ratio.

3.3 FOLLOW-UP VERIFICATION

Upon completion of acceptance checks, settings, and tests, the contractor shall demonstrate that the transformers are in good operating condition and properly performing the intended function.

3.4 SPARE PARTS

Deliver the following spare parts for the project to the COTR two weeks prior to final inspection:

Six stand-off insulators.

Six insulated protective caps.

One spare set of medium-voltage fuses for each size fuse used in the project.

3.5 INSTRUCTIONS

The contractor shall instruct maintenance personnel, for not less than one 2-hour period, on the maintenance and operation of the equipment on the date requested by the COTR.

- - - E N D - - -

SECTION 26 24 11
DISTRIBUTION SWITCHBOARDS

PART 1 - GENERAL

1.1 DESCRIPTION

This section specifies the furnishing, installation, and connection of the distribution switchboards.

1.2 RELATED WORK

Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS: General electrical requirements and items that are common to more than one section of Division 26.

Section 26 05 21, LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES (600 VOLTS AND BELOW): Cables and wiring.

Section 26 05 26, GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS: Requirements for Personnel Safety and to provide a low impedance path for possible fault currents.

Section 26 05 33, RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS: Conduit and outlet boxes.

Section 26 43 13, TRANSIENT-VOLTAGE SURGE SUPPRESSION: TVSS equipment for distribution switchboards.

1.3 QUALITY ASSURANCE

Refer to Paragraph, QUALIFICATIONS, in Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS.

1.4 FACTORY TESTS

Distribution switchboards shall be thoroughly tested at the factory to assure that there are no electrical or mechanical defects. Tests shall be conducted as per NEMA PB 2 and UL 891. Factory tests shall be certified.

The following additional tests shall be performed:

Verify that circuit breaker sizes and types correspond to drawings and coordination study.

Verify tightness of bolted electrical connections by calibrated torque-wrench method in accordance with manufacturer's published data.

Confirm correct operation and sequencing of electrical and mechanical interlock systems by attempting closure on locked-open devices, and attempting to open locked-closed devices, and making key exchange with devices operated in off-normal positions.

Exercise all active components.

Perform a dielectric withstand voltage test on each bus section, each phase-to-ground with phases not under test grounded, in accordance with manufacturer's published data.

Perform insulation-resistance tests on control wiring with respect to ground. Applied potential shall be 500 volts dc for 300-volt rated cable and 1000 volts dc for 600-volt rated cable, or as required if solid-state components or control devices cannot tolerate the applied voltage.

If applicable, verify correct function of control transfer relays located in the switchboard with multiple control power sources.

Furnish four (4) copies of certified manufacturer's factory test reports to the COTR prior to shipment of the switchboards to ensure that the switchboards have been successfully tested as specified.

The Government shall have an option to witness the factory tests. All expenses of the Government Representative's trips to witness the testing will be paid by the Government. Notify the COTR not less than 30 days prior to making tests at the factory.

1.5 SUBMITTALS

Submit in accordance with Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS:

A. Shop Drawings:

Sufficient information, clearly presented, shall be included to determine compliance with drawings and specifications.

Include electrical ratings, dimensions, mounting details, materials, required clearances, terminations, weight, temperature rise, wiring and connection diagrams, plan, front, side, and rear elevations, sectional views, bus work, circuit breaker frame sizes, trip and short-circuit rating, long-time, short-time, instantaneous and ground fault settings, coordinated breaker and fuse curves, accessories, and device nameplate data.

Show the size, ampere-rating, number of bars per phase and neutral in each bus run (horizontal and vertical), bus spacing, equipment ground bus, and bus material.

B. Manuals:

1. Submit, simultaneously with the shop drawings, companion copies of complete maintenance and operating manuals including technical data sheets, wiring diagrams, and information for ordering replacement parts.

Wiring diagrams shall have their terminals identified to facilitate installation, maintenance, and operation.

Wiring diagrams shall indicate internal wiring for each item of equipment and the interconnection between the items of equipment. Provide a clear and concise description of operation, which gives, in detail, the information required to properly operate the equipment.

Approvals will be based on complete submissions of manuals together with shop drawings.

2. Two weeks prior to final inspection, deliver four copies of the final updated maintenance and operating manuals to the COTR. The manuals shall be updated to include any information necessitated by shop drawing approval.

Complete "As Installed" wiring and schematic diagrams shall be included which show all items of equipment and their interconnecting wiring.

Show all terminal identification.

Include information for testing, repair, trouble shooting, assembly, disassembly, and recommended maintenance intervals.

Provide a replacement parts list with current prices. Include a list of recommended spare parts, tools, and instruments for testing and maintenance purposes.

Furnish manuals in loose-leaf binder or manufacturer's standard binder.

C. Certifications:

1. Two weeks prior to final inspection, submit four copies of the following to the COTR:

Certification by the Contractor that the assemblies have been properly installed, adjusted and tested, including circuit breakers settings.

Certified copies of all of the factory design and production tests, field test data sheets and reports for the assemblies. 1.6

APPLICABLE PUBLICATIONS

Publications listed below (including amendments, addenda, revisions, supplements and errata) form a part of this specification to the extent referenced. Publications are referenced in the text by basic designation only.

- A. Institute of Engineering and Electronic Engineers (IEEE):

C37.13	.....	Low Voltage AC Power Circuit Breakers Used in Enclosures
C57.13	.....	Instrument Transformers
C62.41	.....	Surge Voltage in Low Voltage AC Power Circuits
C62.45	.....	Surge Testing for Equipment connected to Low-Voltage AC Power Circuits

National Electrical Manufacturer's Association (NEMA):

PB-2	.....	Dead-Front Distribution Switchboards.
PB-2.1	.....	Instructions for Proper Handling, Installation, Operation, and Maintenance of Switchboards
AB-1	.....	Molded Case Circuit Breakers, Molded Case Switches and Circuit Breaker Enclosures

National Fire Protection Association (NFPA):

70	National Electrical Code (NEC)
----	-------	--------------------------------

Underwriters Laboratories, Inc. (UL):

67	.....	Panelboards
489	.....	Molded Case Circuit Breakers and Circuit Breakers Enclosures
891	.....	Dead-Front Switchboards
1283	.....	Electromagnetic Interference Filters
1449	.....	Transient Voltage Surge Suppressors

PART 2 - PRODUCTS

2.1 GENERAL

Switchboards shall be in accordance with UL, NEMA, NEC, IEEE, and as shown on the drawings.

Switchboards shall be provided complete, ready for operation including, but not limited to housing, buses, circuit breakers, instruments and related transformers, fuses, and wiring.

Switchboard dimensions shall not exceed the dimensions shown on the drawings.

Manufacturer's nameplate shall include complete ratings of switchboard in addition to the date of manufacture.

2.2 BASIC ARRANGEMENT

A. Type I: Switchboard shall be front accessible with the following features:

1. Device mounting:

Main breaker: Individually mounted and compartmented or group mounted with feeder breakers.

Feeder breakers: Group mounted.

2. Section alignment: As shown on the drawings.
3. Accessibility:
 - Main section line and load terminals: Front and side.
 - Distribution section line and load terminals: Front.
 - Through bus connections: Front and end.
4. Bolted line and load connections.
5. Full height wiring gutter covers for access to wiring terminals.
6. Short Circuit Current Rating: 65k amperes rms symmetrical, minimum, or as shown on the drawings, whichever is higher.

2.3 HOUSING

Provide a completely enclosed, free standing, steel enclosure not less than the gage required by the ANSI and UL standards. The enclosure is to consist of the required number of vertical sections bolted together to form one metal enclosed rigid switchboard. The sides, top and rear shall be covered with removable screw on sheet steel plates.

Provide ventilating louvers where required to limit the temperature rise of current carrying parts. All openings shall be protected against entrance of falling dirt, water, or foreign matter.

Enclosure shall be thoroughly cleaned, phosphate treated, and primed with rust-inhibiting paint. Final finish coat to be the manufacturers standard gray. Provide a quart of finish paint for touch-up purposes.

2.4 BUSES

General: Buses shall be arranged for 3 phase, 4 wire distribution. Main phase buses (through bus), full size neutral bus, and ground bus shall be full capacity the entire length of the switchboard. Provide for future extensions by means of bolt holes or other approved method. Brace the bus to withstand the available short circuit current at the particular location and as shown on the drawings. No magnetic material shall be used between buses to form a magnetic loop.

Material and Size: Buses and connections shall be hard drawn copper of 98 percent conductivity. Bus temperature rise shall not exceed 65 degrees C (149 degrees F). Section busing shall be sized based on UL and NEMA Switchboard Standards.

Bus Connections: All contact surfaces shall be copper. Provide a minimum of two plated bolts per splice. Where physical bus size permits only one bolt, provide a means other than friction to prevent turning, twisting or bending. Torque bolts to the manufacturer's recommended values.

Neutral Bus: Provide bare or plated bus and mount on insulated bus supports. Provide neutral disconnect link to permit isolation of neutral bus from the common ground bus and service entrance conductors.

Ground Bus: Provide an uninsulated 6 mm by 50 mm (1/4 inch by 2 inch) copper equipment ground bus bar sized per UL 891 the length of the switchboard and secure at each section.

Main Bonding Jumper: Connect an uninsulated 1/4 inch by 2 inch (6mm by 50 mm) copper bus between the neutral and ground buses to establish the system common ground point.

2.5 TRANSIENT VOLTAGE SURGE SUPPRESSION

Refer to Section 26 43 13, TRANSIENT-VOLTAGE SURGE

SUPPRESSION. 2.6 NAMEPLATES AND MIMIC BUS

A. Nameplates: For Normal Power system, provide laminated black phenolic resin with white core with 1/2 inch [12mm] engraved lettered nameplates next to each circuit breaker. For Essential Electrical System, provide laminated red phenolic resin with white core with 1/2 inch [12mm] engraved lettered nameplates next to each circuit breaker. Nameplates shall indicate equipment served, spaces, or spares in accordance with one line diagram shown on drawings. Nameplates shall be mounted with plated screws on front of breakers or on equipment enclosure next to breakers. Mounting nameplates only with adhesive is not acceptable.

2.7 PROVISION FOR FUTURE

Where "provision for", "future", or "space" is noted on drawings, the space shall be equipped with bus connections to the future overcurrent device with suitable insulation and bracing to maintain proper short circuit rating and physical clearance. Provide buses for the ampere rating as shown for the future device.

2.8 CONTROL WIRING

Control wiring shall be 600 volt class B stranded SIS. Install all control wiring complete at the factory adequately bundled and protected. Wiring across hinges and between shipping units shall be Class C stranded. Size in accordance with NEC. Provide control circuit fuses.

2.9 MAIN CIRCUIT BREAKERS

A. Type I Switchboard: Provide UL listed and labeled molded case circuit breakers in accordance with NEC and as shown on the drawings. Circuit breakers shall be the solid state adjustable trip type.

1. Trip units shall have field adjustable tripping characteristics as follows:

a. Ampere setting (continuous).

Long time band.

Short time trip point.

Short time delay.

Instantaneous trip point.

Ground fault trip point.

Ground fault trip delay.

Trip settings shall be as indicated on the drawings. Final settings shall be as shown on the electrical system protective device study. Breakers, which have same rating, shall be interchangeable with each other.

Rating shall be 3-pole, 600 volts AC, 60-cycle with indicated frame size, trip rating and system voltage. Interrupting rating shall be without instantaneous trip.

Position indicator: Provide an indicator visible from the front of the unit to indicate whether the breaker is open or closed.

Trip button: Provide a mechanical trip button accessible from the front of the door to trip the breaker.

Padlocking: Include provisions for padlocking the breaker in the open position.

Operation: Unless otherwise shown on the drawings, breakers 1600 ampere frame size and less shall be manually operated. Breakers larger than 1600 amperes frame size shall be electrically operated.

Trip devices shall have the following features:

Trip device in each pole.

Mechanically and electrically trip free.

Long time element with adjustable pick-up and selective maximum, intermediate, and minimum time delay bands.

Short time element with adjustable pick-up and selective maximum, intermediate, and minimum time delay bands.

6) Final settings of pick-up and time bands shall be as shown on the drawings.

2.10 FEEDER CIRCUIT BREAKERS

Provide UL listed and labeled molded case circuit breakers, in accordance with the NEC, as shown on the drawings, and as herein specified.

Adjustable Trip Molded Case Circuit Breakers:

1. Provide molded case, solid state adjustable trip type circuit breakers.

2. Trip units shall have field adjustable tripping characteristics as follows:
 - Ampere setting (continuous).
 - Long time band.
 - Short time trip point.
 - Short time delay.
 - Instantaneous trip point.
 - Ground fault trip point.
 - Ground fault trip delay.
3. Trip settings shall be as indicated on the drawings.
4. Breakers, which have same rating, shall be interchangeable with each other.

PART 3 - EXECUTION

3.1 INSTALLATION

Install the switchboard in accordance with the NEC, as shown on the drawings, and as recommended by the manufacturer.

Anchor switchboard to the slab with plated 1/2 inch [12.5mm] minimum anchor bolts, or as recommended by the manufacturer.

Exterior Location. Mount switchboard on concrete slab. Unless otherwise indicated, the slab shall be at least 8 inches [200mm] thick, reinforced with a 6 by 6 inch [150 by 150mm] No. 6 mesh placed uniformly 4 inches [100mm] from the top of the slab. Slab shall be placed on a 6 inch [150mm] thick, well-compacted gravel base. The top of the concrete slab shall be approximately 4 inches [100mm] above the finished grade. Edges above grade shall have 1/2 inch [12.5mm] chamfer. The slab shall be of adequate size to project at least 8 inches [200mm] beyond the equipment. Provide conduit turnups and cable entrance space required by the equipment to be mounted. Seal voids around conduit openings in slab with water- and oil-resistant caulking or sealant. Cut off and bush conduits 3 inches [75mm] above slab surface. Concrete work shall be as specified in Section 03 30 00, CAST-IN-PLACE CONCRETE.

3.2 ACCEPTANCE CHECKS AND TESTS

- A. Perform in accordance with the manufacturer's recommendations. Include the following visual and mechanical inspections and electrical tests:
 1. Visual and Mechanical Inspection
 - Compare equipment nameplate data with specifications and approved shop drawings.
 - Inspect physical, electrical, and mechanical condition.

Confirm correct application of manufacturer's recommended lubricants.

Verify appropriate anchorage, required area clearances, and correct alignment.

Verify that circuit breaker sizes and types correspond to approved shop drawings.

Verifying tightness of accessible bolted electrical connections by calibrated torque-wrench method, or performing thermographic survey after energization.

Confirm correct operation and sequencing of electrical and mechanical interlock systems.

Clean switchboard.

Inspect insulators for evidence of physical damage or contaminated surfaces.

Verify correct shutter installation and operation.

Exercise all active components.

Verify the correct operation of all sensing devices, alarms, and indicating devices.

If applicable, verify that vents are clear.

If applicable, inspect control power transformers. 2.

Electrical Tests

Perform insulation-resistance tests on each bus section.

Perform overpotential tests.

3.3 FOLLOW-UP VERIFICATION

Upon completion of acceptance checks, settings, and tests, the Contractor shall show by demonstration in service that the switchboard is in good operating condition and properly performing the intended function. Circuit breakers shall be tripped by operation of each protective device.

3.4 INSTRUCTION

Furnish the services of a factory certified instructor for one 4 hour period for instructing personnel in the operation and maintenance of the switchboard and related equipment on the date requested by the COTR.

- - - E N D - - -

THIS PAGE INTENTIONALLY LEFT BLANK

SECTION 26 24 16
PANELBOARDS

PART 1 - GENERAL

1.1 DESCRIPTION

This section specifies the furnishing, installation, and connection of panelboards.

1.2 RELATED WORK

Section 09 91 00, PAINTING: Identification and painting of panelboards.
Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS: General electrical requirements and items that are common to more than one Section of Division 26.

Section 26 05 21, LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES (600 VOLTS AND BELOW): Cables and wiring.

Section 26 05 26, GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS: Requirements for personnel safety and to provide a low impedance path for possible ground fault currents.

Section 26 05 33, RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS: Conduits and outlet boxes.

Section 26 43 13, TRANSIENT-VOLTAGE SURGE SUPPRESSION: Surge suppressors installed in panelboards.

1.3 QUALITY ASSURANCE

Refer to Paragraph, QUALIFICATIONS, in Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS.

1.4 SUBMITTALS

A. Submit in accordance with Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS.

B. Shop Drawings:

Sufficient information, shall be clearly presented to determine compliance with drawings and specifications.

Include electrical ratings, dimensions, mounting details, materials, wiring diagrams, accessories, and weights of equipment. Complete nameplate data, including manufacturer's name and catalog number.

C. Manuals:

1. When submitting the shop drawings, submit companion copies of complete maintenance and operating manuals, including technical data sheets and wiring diagrams.

2. If changes have been made to the maintenance and operating manuals that were originally submitted, then submit four copies of updated maintenance and operating manuals to the COTR two weeks prior to final inspection.

Certification: Two weeks prior to final inspection, submit four copies of the following to the COTR:

Certification by the manufacturer that the materials conform to the requirements of the drawings and specifications.

Certification by the contractor that the materials have been properly installed, connected, and tested.

1.5 APPLICABLE PUBLICATIONS

Publications listed below (including amendments, addenda, revisions, supplements, and errata) form a part of this specification to the extent referenced. Publications are referenced in the text by designation only.

National Electrical Manufacturers Association (NEMA):

PB-1-06Panelboards

250-08Enclosures for Electrical Equipment (1000V
Maximum)

National Fire Protection Association (NFPA):

70-2005 National Electrical Code (NEC)

70E-2004Standard for Electrical Life Safety in the
Workplace

Underwriters Laboratories, Inc. (UL):

50-95Enclosures for Electrical Equipment

67-09 Panelboards

489-09Molded Case Circuit Breakers and Circuit
Breaker Enclosures

PART 2 - PRODUCTS

2.1 PANELBOARDS

Panelboards shall be in accordance with UL, NEMA, NEC, and as shown on the drawings.

Panelboards shall be standard manufactured products.

All panelboards shall be lockable, hinged "door in door" type with:

1. Interior hinged door with hand-operated latch or latches, as required to provide access only to circuit breaker operating handles, not to energized parts.

Outer hinged door shall be securely mounted to the panelboard box with factory bolts, screws, clips, or other fasteners, requiring a tool for entry. Hand-operated latches are not acceptable.

Push inner and outer doors shall open left to right.

All panelboards shall be completely factory-assembled with molded case circuit breakers and integral accessories, such as surge protective devices per Section 26 43 13, TRANSIENT-VOLTAGE SURGE SUPPRESSION, and as scheduled on the drawings or specified herein. Include one-piece removable, inner dead front cover, independent of the panelboard cover.

Panelboards shall have main breaker or main lugs, bus size, voltage, phase, top or bottom feed, and flush or surface mounting as scheduled on the drawings.

Panelboards shall conform to NEMA PB-1, NEMA AB-1, and UL 67 and have the following features:

Non-reduced size copper bus bars with current ratings as shown on the panel schedules, rigidly supported on molded insulators.

Bus bar connections to the branch circuit breakers shall be the "distributed phase" or "phase sequence" type.

Mechanical lugs furnished with panelboards shall be cast, stamped, or machined metal alloys of sizes suitable for the conductors to which they will be connected.

Neutral bus shall be 100% rated, mounted on insulated supports.

Grounding bus bar shall be equipped with screws or lugs for the connection of grounding wires.

Buses shall be braced for the available short-circuit current.

Bracing shall not be less than 10,000 A symmetrical for 120/208 V and 120/240 V panelboards.

Branch circuit panelboards shall have buses fabricated for bolt-on type circuit breakers.

Protective devices shall be designed so that they can easily be replaced.

Where designated on panel schedule "spaces," include all necessary bussing, device support, and connections. Provide blank cover for each space.

In two section panelboards, the main bus in each section shall be full size. The first section shall be furnished with subfeed lugs on the line side of main lugs only, or through-feed lugs for main breaker type panelboards, and have cable connections to the second section. Panelboard sections with tapped bus or crossover bus are not acceptable.

Series-rated panelboards are not permitted.

2.2 CABINETS AND TRIMS

A. Cabinets:

Provide galvanized steel cabinets to house panelboards. Cabinets for outdoor panelboards shall be factory primed and suitably treated with a corrosion-resisting paint finish meeting UL 50 and UL 67.

Cabinet enclosure shall not have ventilating openings.

Cabinets for panelboards may be of one-piece formed steel or of formed sheet steel with end and side panels welded, riveted, or bolted as required.

2.3 MOLDED CASE CIRCUIT BREAKERS FOR PANELBOARDS

Circuit breakers shall be per UL 489, in accordance with the NEC, as shown on the drawings, and as specified.

Circuit breakers in panelboards shall be bolt-on type.

Molded case circuit breakers shall have minimum interrupting rating as required to withstand the available fault current, but not less than:

1. 120/208 V Panelboard: 10,000 A symmetrical.

Molded case circuit breakers shall have automatic, trip free, non-adjustable, inverse time, and instantaneous magnetic trips for 100 A frame or lower.

Breaker features shall be as follows:

A rugged, integral housing of molded insulating material.

Silver alloy contacts.

Arc quenchers and phase barriers for each pole.

Quick-make, quick-break, operating mechanisms.

A trip element for each pole, thermal magnetic type with long time delay and instantaneous characteristics, a common trip bar for all poles and a single operator.

Electrically and mechanically trip free.

An operating handle which indicates ON, TRIPPED, and OFF positions.

An overload on one pole of a multipole breaker shall automatically cause all the poles of the breaker to open.

9. Ground fault current interrupting breakers, shunt trip breakers, or other accessory devices or functions shall be provided where indicated.

2.4 SURGE SUPPRESSION

Where shown on drawings, furnish panelboard with integral transient voltage surge suppression device. Refer to Section 26 43 13, TRANSIENT-VOLTAGE SURGE SUPPRESSION.

PART 3 - EXECUTION

3.1 INSTALLATION

Installation shall be in accordance with the manufacturer's instructions, the NEC, as shown on the drawings, and as specified.

Locate panelboards so that the present and future conduits can be conveniently connected.

Install a printed schedule of circuits in each panelboard after approval by the COTR. Schedules shall be printed on the panelboard directory cards, installed in the appropriate panelboards, and incorporate all applicable contract changes. Information shall indicate outlets, lights, devices, or other equipment controlled by each circuit, and the final room numbers served by each circuit.

Mount the fully-aligned panelboard such that the maximum height of the top circuit breaker above the finished floor shall not exceed 78 in [1980 mm]. Mount panelboards that are too high such that the bottom of the cabinets will not be less than 6 in [150 mm] above the finished floor.

For panelboards located in areas accessible to the public, paint the exposed surfaces of the trims, doors, and boxes with finishes to match surrounding surfaces after the panelboards have been installed.

Rust and scale shall be removed from the inside of existing backboxes where new panelboards are to be installed. Paint inside of backboxes with rust-preventive paint before the new panelboard interior is installed. Provide new trim and doors for these panelboards. Covers shall fit tight to the box with no gaps between the cover and the box.

3.2 ACCEPTANCE CHECKS AND TESTS

A. Perform in accordance with the manufacturer's recommendations. Include the following visual and mechanical inspections and electrical tests:

1. Visual and Mechanical Inspection

Compare equipment nameplate data with specifications and approved shop drawings.

Inspect physical, electrical, and mechanical condition.

Verify appropriate anchorage and required area clearances.

Verify that circuit breaker sizes and types correspond to approved shop drawings.

To verify tightness of accessible bolted electrical connections, use the calibrated torque-wrench method or perform thermographic survey after energization.

Clean panelboard.

3.3 FOLLOW-UP VERIFICATION

Upon completion of acceptance checks, settings, and tests, the contractor shall demonstrate that the panelboards are in good operating condition and properly performing the intended function.

- - - E N D - - -

SECTION 26 27 26
WIRING DEVICES

PART 1 - GENERAL

1.1 DESCRIPTION

This section specifies the furnishing, installation and connection of wiring devices.

1.2 RELATED WORK

Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS: General electrical requirements that are common to more than one section of Division 26.

Section 26 05 33, RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS: Conduits and outlets boxes.

Section 26 05 21, LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES (600 VOLTS AND BELOW): Cables and wiring.

Section 26 05 26, GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS:

Requirements for personnel safety and to provide a low impedance path to ground for possible ground fault currents.

1.3 QUALITY ASSURANCE

Refer to Paragraph, QUALIFICATIONS, in Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS.

1.4 SUBMITTALS

A. In accordance with Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS, submit the following:

B. Shop Drawings:

Sufficient information, clearly presented, shall be included to determine compliance with drawings and specifications.

Include electrical ratings, dimensions, mounting details, construction materials, grade and termination information.

C. Manuals: Two weeks prior to final inspection, deliver four copies of the following to the COTR: Technical data sheets and information for ordering replacement units.

D. Certifications: Two weeks prior to final inspection, submit four copies of the following to the COTR: Certification by the Contractor that the devices comply with the drawings and specifications, and have been properly installed, aligned, and tested.

1.5 APPLICABLE PUBLICATIONS

A. Publications listed below (including amendments, addenda, revisions, supplements and errata) form a part of this specification to the extent

referenced. Publications are referenced in the text by basic designation only.

National Fire Protection Association (NFPA):

70 National Electrical Code (NEC)

National Electrical Manufacturers Association (NEMA):

WD 1 General Color Requirements for Wiring Devices

WD 6 Wiring Devices - Dimensional Requirements

Underwriter's Laboratories, Inc. (UL):

5 Surface Metal Raceways and Fittings

20 General-Use Snap Switches

231 Power Outlets

467 Grounding and Bonding Equipment

498 Attachment Plugs and Receptacles

943 Ground-Fault Circuit-Interrupters

PART 2 - PRODUCTS

2.1 RECEPTACLES

A. General: All receptacles shall be listed by Underwriters Laboratories, Inc., and conform to NEMA WD 6.

Mounting straps shall be plated steel, with break-off plaster ears and shall include a self-grounding feature. Terminal screws shall be brass, brass plated or a copper alloy metal.

Receptacles shall have provisions for back wiring with separate metal clamp type terminals (four min.) and side wiring from four captively held binding screws.

B. Duplex Receptacles: Hospital-grade, single phase, 20 ampere, 120 volts, 2-pole, 3-wire, and conform to the NEMA 5-20R configuration in NEMA WD 6. The duplex type shall have break-off feature for two-circuit operation. The ungrounded pole of each receptacle shall be provided with a separate terminal.

1. Bodies shall be ivory in color.

2. Switched duplex receptacles shall be wired so that only the top receptacle is switched. The remaining receptacle shall be unswitched.

3. Duplex Receptacles on Emergency Circuit:

Bodies shall be red in color.

In rooms without emergency powered general lighting, the emergency receptacles shall be of the self-illuminated type and will be labeled with 1/4 inch letters: "EMERGENCY".

4. Ground Fault Interrupter Duplex Receptacles: Shall be an integral unit, hospital-grade, suitable for mounting in a standard outlet box.

Ground fault interrupter shall be consist of a differential current transformer, solid state sensing circuitry and a circuit interrupter switch. Device shall have nominal sensitivity to ground leakage current of five milliamperes and shall function to interrupt the current supply for any value of ground leakage current above five milliamperes (+ or - 1 milliamp) on the load side of the device. Device shall have a minimum nominal tripping time of 1/30th of a second.

Ground Fault Interrupter Duplex Receptacles (not hospital-grade) shall be the same as ground fault interrupter hospital-grade receptacles except for the "hospital-grade" listing.

5

- D. Weatherproof Receptacles: Shall consist of a duplex receptacle, mounted in box with a gasketed, weatherproof, cast metal cover plate and cap over each receptacle opening. The cap shall be permanently attached to the cover plate by a spring-hinged flap. The weatherproof integrity shall not be affected when heavy duty specification or hospital grade attachment plug caps are inserted. Cover plates on outlet boxes mounted flush in the wall shall be gasketed to the wall in a watertight manner.

2.2 TOGGLE SWITCHES

- A. Toggle Switches: Shall be totally enclosed tumbler type with bodies of phenolic compound. Toggle handles shall be ivory in color unless otherwise specified. The rocker type switch is not acceptable and will not be approved.

Switches installed in hazardous areas shall be explosion proof type in accordance with the NEC and as shown on the drawings.

Shall be single unit toggle, butt contact, quiet AC type, heavy-duty general-purpose use with an integral self grounding mounting strap with break-off plaster ears and provisions for back wiring with separate metal wiring clamps and side wiring with captively held binding screws.

Ratings:

120 volt circuits: 20 amperes at 120-277 volts AC.

277 volt circuits: 20 amperes at 120-277 volts AC.

2.3 MANUAL DIMMING CONTROL

Slide dimmer with on/off control, single-pole or three-way as shown on plans. Faceplates shall be ivory in color unless otherwise specified. Manual dimming controls shall be fully compatible with electronic dimming ballasts and approved by the ballast manufacturer, shall operate

over full specified dimming range, and shall not degrade the performance or rated life of the electronic dimming ballast and lamp.

2.4 WALL PLATES

Wall plates for switches and receptacles shall be 302 stainless steel as indicated or approved. Oversize plates are not acceptable.

Standard NEMA design, so that products of different manufacturers will be interchangeable. Dimensions for openings in wall plates shall be accordance with NEMA WD 6.

For receptacles or switches mounted adjacent to each other, wall plates shall be common for each group of receptacles or switches.

Duplex Receptacles on Emergency Circuit:

1. Bodies shall be red in color. Wall plates shall be red with the word "EMERGENCY" engraved in 6 mm, (1/4 inch) white letters.

PART 3 - EXECUTION

3.1 INSTALLATION

Installation shall be in accordance with the NEC and as shown as on the drawings.

Ground terminal of each receptacle shall be bonded to the outlet box with an approved green bonding jumper, and also connected to the green equipment grounding conductor.

Outlet boxes for light and dimmer switches shall be mounted on the strike side of doors.

Provide barriers in multigang outlet boxes to separate systems of different voltages, Normal Power and Emergency Power systems, and in compliance with the NEC.

Coordinate with other work, including painting, electrical boxes and wiring installations, as necessary to interface installation of wiring devices with other work. Coordinate the electrical work with the work of other trades to ensure that wiring device flush outlets are positioned with box openings aligned with the face of the surrounding finish material. Pay special attention to installations in cabinet work, and in connection with laboratory equipment.

Exact field locations of floors, walls, partitions, doors, windows, and equipment may vary from locations shown on the drawings. Prior to locating sleeves, boxes and chases for roughing-in of conduit and equipment, the Contractor shall coordinate exact field location of the above items with other trades. In addition, check for exact direction of door swings so that local switches are properly located on the strike side.

Install wall switches 48 inches [1200mm] above floor, OFF position down.

Install wall dimmers 48 inches [1200mm] above floor; derate ganged dimmers as instructed by manufacturer; do not use common neutral.

Install convenience receptacles 18 inches [450mm] above floor, and 6 inches [152mm] above counter backsplash or workbenches. Install specific-use receptacles at heights shown on the drawings.

Label device plates with a permanent adhesive label listing panel and circuit feeding the wiring device.

Test wiring devices for damaged conductors, high circuit resistance, poor connections, inadequate fault current path, defective devices, or similar problems using a portable receptacle tester. Correct circuit conditions, remove malfunctioning units and replace with new, and retest as specified above.

Test GFCI devices for tripping values specified in UL 1436 and UL 943. -

- - E N D - - -

THIS PAGE INTENTIONALLY LEFT BLANK

SECTION 26 29 11
MOTOR STARTERS

PART 1 - GENERAL

1.1 DESCRIPTION

All motor starters and variable speed motor controllers, including installation and connection (whether furnished with the equipment specified in other Divisions or otherwise), shall meet these specifications.

1.2 RELATED WORK

Other sections which specify motor driven equipment, except elevator motor controllers.

Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS: General electrical requirements and items that are common to more than one Section of Division 26.

Section 26 05 26, GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS:

Requirements for personnel safety and to provide a low impedance path for possible ground fault currents.

1.3 QUALITY ASSURANCE

Refer to Paragraph, QUALIFICATIONS, in Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS.

1.4 SUBMITTALS

A. Submit in accordance with Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS:

B. Shop Drawings:

Sufficient information, clearly presented, shall be included to determine compliance with drawings and specifications.

Include electrical ratings, dimensions, weights, mounting details, materials, running over current protection, size of enclosure, over current protection, wiring diagrams, starting characteristics, interlocking and accessories.

C. Manuals:

1. Submit, simultaneously with the shop drawings, companion copies of complete maintenance and operating manuals, including technical data sheets, wiring diagrams and information for ordering replacement parts.

Wiring diagrams shall have their terminals identified to facilitate installation, maintenance and operation.

Wiring diagrams shall indicate internal wiring for each item of equipment and interconnections between the items of equipment.

c. Elementary schematic diagrams shall be provided for clarity of operation.

2. Two weeks prior to the project final inspection, submit four copies of the final updated maintenance and operating manual to the COTR. D. Certification: Two weeks prior to final inspection, unless otherwise noted, submit four copies of the following certifications to the COTR. Certification that the equipment has been properly installed, adjusted, and tested.

Certification by the manufacturer that medium voltage motor controller(s) conforms to the requirements of the drawings and specifications. This certification must be furnished to the COTR prior to shipping the controller(s) to the job site.

1.5 APPLICABLE PUBLICATIONS

Publications listed below (including amendments, addenda, revisions, supplements and errata) form a part of this specification to the extent referenced. Publications are referenced in the text by basic designation only.

Institute of Electrical and Electronic Engineers (IEEE):

519 Recommended Practices and Requirements for Harmonic Control in Electrical Power Systems
C37.90.1 Standard Surge Withstand Capability (SWC) Tests for Protective Relays and Relay Systems

National Electrical Manufacturers Association (NEMA):

ICS 1 Industrial Control and Systems General Requirements
ICS 1.1 Safety Guidelines for the Application, Installation and Maintenance of Solid State Control
ICS 2 Industrial Control and Systems, Controllers, Contactors and Overload Relays Rated 600 Volts DC
ICS 6 Industrial Control and Systems Enclosures
ICS 7 Industrial Control and Systems Adjustable-Speed Drives
ICS 7.1 Safety Standards for Construction and Guide for Selection, Installation and Operation of Adjustable-Speed Drive Systems

National Fire Protection Association (NFPA):

70 National Electrical Code (NEC)

E. Underwriters Laboratories Inc. (UL):

508 Industrial Control Equipment

PART 2 - PRODUCTS

2.1 MOTOR STARTERS, GENERAL

Shall be in accordance with the requirements of the IEEE, NEC, NEMA (ICS 1, ICS 1.1, ICS 2, ICS 6, ICS 7 and ICS 7.1) and UL.

Shall have the following features:

1. Separately enclosed unless part of another assembly.
2. Circuit breakers and safety switches within the motor controller enclosures shall have external operating handles with lock-open padlocking provisions and shall indicate the ON and OFF positions.

3. Motor control circuits:

- a. Shall operate at not more than 120 volts.
- b. Shall be grounded except as follows:
Where isolated control circuits are shown.
Where manufacturers of equipment assemblies recommend that the control circuits be isolated.
- c. Incorporate a separate, heavy duty, control transformer within each motor controller enclosure to provide the control voltage for each motor operating over 120 volts.
- d. Incorporate over current protection for both primary and secondary windings of the control power transformers in accordance with the NEC.

4. Overload current protective devices:

Overload relay (solid state type).

One for each pole.

Manual reset on the door of each motor controller enclosure.

Correctly sized for the associated motor's rated full load current.

Check every motor controller after installation and verify that correct sizes of protective devices have been installed.

Deliver four copies of a summarized list to the COTR, which indicates and adequately identifies every motor controller installed. Include the catalog numbers for the correct sizes of protective devices for the motor controllers.

5. Hand-Off-Automatic (H-O-A) switch is required unless specifically stated on the drawings as not required for a particular starter. H-OA switch is not required for manual motor starters.

Incorporate into each control circuit a 120-volt, solid state time delay relay (ON delay), minimum adjustable range from 0.3 to 10 minutes, with transient protection. Time delay relay is not required where H-O-A switch is not required.

Unless noted otherwise, equip with not less than two normally open and two normally closed auxiliary contacts. Provide green run pilot lights and H-O-A control devices as indicated, operable at front of enclosure without opening enclosure. Push buttons, selector switches, pilot lights, etc., shall be interchangeable.

Enclosures:

Shall be the NEMA types shown on the drawings for the motor controllers and shall be the NEMA types which are the most suitable for the environmental conditions where the motor controllers are being installed.

Doors mechanically interlocked to prevent opening unless the breaker or switch within the enclosure is open. Provision for padlock must be provided.

Enclosures shall be primed and finish coated at the factory with the manufacturer's prime coat and standard finish.

Motor controllers incorporated with equipment assemblies shall also be designed for the specific requirements of the assemblies.

Additional requirements for specific motor controllers, as indicated in other sections, shall also apply.

Provide a disconnecting means or safety switch near and within sight of each motor. Provide all wiring and conduit required to facilitate a complete installation.

2.2 MANUAL MOTOR STARTERS

A. Shall be in accordance with applicable requirements of 2.1 above.

B. Manual motor starters.

Starters shall be general-purpose Class A, manually operated type with full voltage controller for induction motors, rated in horsepower.

Units shall include overload and low voltage protection, red pilot light, NO auxiliary contact and toggle operator.

C. Fractional horsepower manual motor starters.

Starters shall be general-purpose Class A, manually operated with full voltage controller for fractional horsepower induction motors.

Units shall include thermal overload protection, red pilot light and toggle operator.

D. Motor starting switches.

Switches shall be general-purpose Class A, manually operated type with full voltage controller for fractional horsepower induction motors.

Units shall include thermal overload protection, red pilot light low voltage protection, NO auxiliary contact and toggle operator.

2.3 MAGNETIC MOTOR STARTERS

Shall be in accordance with applicable requirements of 2.1 above.

Starters shall be general-purpose, Class A magnetic controllers for induction motors rated in horsepower. Minimum size 0.

Where combination motor starters are used, combine starter with protective or disconnect device in a common enclosure.

Provide phase loss protection for each starter, with contacts to de-energize the starter upon loss of any phase.

Unless otherwise indicated, provide full voltage non-reversing across-the-line mechanisms for motors less than 75 HP, closed by coil action and opened by gravity. For motors 75 HP and larger, provide reduced voltage starters. Equip starters with 120V AC coils and individual control transformer unless otherwise noted. Locate "reset" button to be accessible without opening the enclosure.

2.4 REDUCED VOLTAGE MOTOR CONTROLLERS

Shall be in accordance with applicable portions of 2.1 above.

Shall be installed as shown for motors on the contract drawings.

Shall have closed circuit transition for the types which can incorporate such transition.

Shall limit inrush currents to not more than 70 percent of the locked rotor currents.

Provide phase loss protection for each starter, with contacts to de-energize the starter upon loss of any phase.

Interrupting ratings shall be not less than the maximum short circuit currents available where the controllers are being installed or as indicated on the drawings.

2.6 VARIABLE SPEED MOTOR CONTROLLERS

Shall be in accordance with applicable portions of 2.1 above.

Shall be solid state, micro processor-based with adjustable frequency and voltage, three phase output capable of driving standard NEMA B design, three phase alternating current induction motors at full rated speed. The drives shall utilize a full wave bridge design incorporating diode rectifier circuitry with pulse width modulation (PWM). Other

control techniques are not acceptable. Silicon controlled rectifiers (SCR) shall not be used in the rectifying circuitry. The drives shall be designed to be used on variable torque loads and shall be capable of providing sufficient torque to allow the motor to break away from rest upon first application of power.

Unit shall be capable of operating within voltage parameters of plus 10 to minus 10 percent of line voltage, and be suitably rated for the full load amps of the maximum watts (HP) within its class.

Operating and Design Conditions:

Elevation: 2,800 feet AMSL

Temperatures: Maximum +90°F Minimum -10°F

Relative Humidity: 95%

Drive Location: Non-Air conditioned Building

Controllers shall have the following features:

Isolated power for control circuits.

Manually re-settable motor overload protection for each phase.

Adjustable current limiting circuitry to provide soft motor starting.

Maximum starting current shall not exceed 200 percent of motor full load current.

Independent acceleration and deceleration time adjustment, manually adjustable from 2 to 30 seconds. (Set timers to the equipment manufacturer's recommended time in the above range.)

Provide 4 to 20 ma current follower circuitry for interface with mechanical sensor devices.

Automatic frequency adjustment from 20 Hz to 60 Hz.

Provide circuitry to initiate an orderly shutdown when any of the conditions listed below occur. The controller shall not be damaged by any of these electrical disturbances and shall automatically restart when the conditions are corrected. The drive shall be able to restart into a rotating motor operating in either the forward or reverse direction and matching that frequency.

Incorrect phase sequence.

Single phasing.

Over voltage in excess of 10 percent.

Under voltage in excess of 10 percent.

Running over current above 110 percent (shall not automatically reset for this condition.)

Instantaneous overcurrent above 150 percent (shall not automatically reset for this condition).

Surge voltage in excess of 1000 volts.

Short duration power outages of 12 cycles or less (i.e., distribution line switching, generator testing, and automatic transfer switch operations.)

8. Automatic Reset/Restart: Attempt three restarts after drive fault or on return of power after an interruption and before shutting down for manual reset or fault correction; adjustable delay time between restart attempts.

Power-Interruption Protection: To prevent motor from re-energizing after a power interruption until motor has stopped, unless "Bidirectional Autospeed Search" feature is available and engaged.

Bidirectional Autospeed Search: Capable of starting VFC into rotating loads spinning in either direction and returning motor to set speed in proper direction, without causing damage to drive, motor, or load.

Minimum efficiency shall be 95 percent at 100 percent speed and 85percent at 50 percent speed.

The displacement power factor of the controller shall not be less than 95 percent under any speed or load condition.

Controllers shall include a door interlocked fused safety disconnect switch or door interlocked circuit breaker switch which will disconnect all input power.

Controller shall include a 3% line reactor, and RFI/EMI filter.

The following accessories are to be door mounted:

AC Power on light.

Ammeter (RMS motor current).

HAND-OFF-AUTOMATIC switch.

Manual speed control in HAND mode.

System protection lights indicating that the system has shutdown and will not automatically restart.

System protection light indicating that the system has shutdown but will restart when conditions return to normal.

Manual variable speed controller by-pass switch.

Diagnostic shutdown indicator lights for each shutdown condition.

Provide two N.O. and two N.C. dry contacts rated 120 volts, 10 amperes, 60 HZ for remote indication of the following:

System shutdown with auto restart.

System shutdown without auto restart.

System running.

Incorporate into each control circuit a 120-volt, time delay relay (ON delay), adjustable from 0.3-10 minutes, with transient protection. Provide transformer/s for the control circuit/s.

Controller shall not add any current or voltage transients to the input AC power distribution system nor shall transients from other devices on the AC power distribution system affect the controller. Controllers shall be protected to comply with IEEE C37.90.1 and UL-508. Line noise and harmonic voltage distortion shall not exceed the values allowed by IEEE 519.

Hardware and software to enable the BAS to monitor, control, and display controller status and alarms.

Network Communications Ports: Ethernet and RS-422/485.

Embedded BAS Protocols for Network Communications: As specified in Division 22.

Bypass Operation: Manually transfers motor between power converter output and bypass circuit, manually, automatically, or both. Unit is capable of stable operation (starting, stopping, and running) with motor completely disconnected from power converter. Transfer between power converter and bypass contactor and retransfer shall only be allowed with the motor at zero speed.

Bypass Controller: Provide contactor-style bypass, arranged to isolate the power converter input and output and permit safe testing of the power converter, both energized and de-energized, while motor is operating in bypass mode. Motor overload protection shall be provided.

Bypass Contactor: Load-break NEMA-rated contactor.

Isolating Switch: Non-load-break switch arranged to isolate power converter and permit safe troubleshooting and testing of the power converter, both energized and de-energized, while motor is operating in bypass mode; pad-lockable, door-mounted handle mechanism.

2.7 MOTOR CONTROL STATIONS

A. Shall have the following features:

Designed for suitably fulfilling the specific control functions for which each station is being installed.

Coordinate the use of momentary contacts and maintained contacts with the complete motor control systems to insure safety for people and equipment.

Each station shall have two pilot lights behind red and green jewels and a circuit to its motor controller. Connect the lamps so they will be energized as follows:

Red while the motor is running.

Green while the motor is stopped.

Where two or more stations are mounted adjacent to each other, install a common wall plate, except where the designs of the stations make such common plates impracticable.

Identify each station with a permanently attached individual nameplate, of laminated black phenolic resin with a white core and engraved lettering not less than 6 mm (1/4-inch) high. Identify the motor by its number or other designation and indicate the function fulfilled by the motor.

B. Components of Motor Control Circuits:

Shall also be designed and arranged so that accidental faulting or grounding of the control conductors will not be able to start the motors.

Use of locking type STOP pushbuttons or switches, which cause motors to restart automatically when the pushbuttons or switches are released, will not be permitted.

PART 3 - EXECUTION

3.1 INSTALLATION

Install motor control equipment in accordance with manufacturer's recommendations, the NEC, NEMA and as shown on the drawings.

Furnish and install heater elements in motor starters and to match the installed motor characteristics. Submit a list of all motors listing motor nameplate rating and heater element installed.

Motor Data: Provide neatly-typed label inside each motor starter enclosure door identifying motor served, nameplate horsepower, full load amperes, code letter, service factor, voltage/phase rating and heater element installed.

Connect hand-off auto selector switches so that automatic control only is by-passed in "manual" position and any safety controls are not by-passed.

Install manual motor starters in flush enclosures in finished areas. Examine control diagrams indicated before ordering motor controllers. Should conflicting data exist in specifications, drawings and diagrams, request corrected data prior to placing orders.

3.2 ADJUSTING

A. Set field-adjustable switches, auxiliary relays, time-delay relays, timers, and overload-relay pickup and trip ranges.

Adjust overload-relay heaters or settings if power factor correction capacitors are connected to the load side of the overload relays.

Adjust trip settings of MCPs and thermal-magnetic circuit breakers with adjustable instantaneous trip elements. Initially adjust at six times the motor nameplate full-load ampere ratings and attempt to start motors several times, allowing for motor cooldown between starts. If tripping occurs on motor inrush, adjust settings in increments until motors start without tripping. Do not exceed eight times the motor full-load amperes (or 11 times for NEMA Premium Efficient motors if required). Where these maximum settings do not allow starting of a motor, notify COTR before increasing settings.

Set the taps on reduced-voltage autotransformer controllers at 50 percent.

In reduced-voltage solid-state controllers, set field-adjustable switches and program microprocessors for required start and stop sequences.

3.3 ACCEPTANCE CHECKS AND TESTS

A. Perform in accordance with the manufacturer's recommendations. Include the following visual and mechanical inspections and electrical tests:

1. Visual and Mechanical Inspection

Compare equipment nameplate data with specifications and approved shop drawings.

Inspect physical, electrical, and mechanical condition.

Inspect contactors.

Clean motor starters and variable speed motor controllers.

Verify overload element ratings are correct for their applications.

If motor-running protection is provided by fuses, verify correct fuse rating.

Verify tightness of accessible bolted electrical connections by calibrated torque-wrench method in accordance with manufacturer's published data.

2. Variable speed motor controllers:

Final programming and connections to variable speed motor controllers shall be by a factory-trained technician. Set all programmable functions of the variable speed motor controllers to meet the requirements and conditions of use.

Test all control and safety features of the variable frequency drive.

3.4 FOLLOW-UP VERIFICATION

Upon completion of acceptance checks, settings, and tests, the Contractor shall show by demonstration in service that the motor starters and variable speed motor controllers are in good operating condition and properly performing the intended functions.

3.5 SPARE PARTS

Two weeks prior to the final inspection, provide one complete set of spare fuses (including heater elements) for each starter/controller installed on this project.

- - - E N D - - -

**SECTION 26 29 21
DISCONNECT SWITCHES**

PART 1 - GENERAL

1.1 DESCRIPTION

This section specifies the furnishing, installation, and connection of low voltage disconnect switches.

1.2 RELATED WORK

Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS: General electrical requirements and items that are common to more than one section of Division 26.

Section 26 05 21, LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES 600 VOLTS AND BELOW: Cables and wiring.

Section 26 05 26, GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS:

Requirements for personnel safety and to provide a low impedance path for possible ground faults.

Section 26 05 33, RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS: Conduits for cables and wiring.

Section 26 29 11, LOW-VOLTAGE MOTOR STARTERS:

Motor rated toggle switches. **1.3 QUALITY**

ASSURANCE

Refer to Paragraph, QUALIFICATIONS, in Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS.

1.4 SUBMITTALS

A. Submit in accordance with Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS.

B. Shop Drawings:

Clearly present sufficient information to determine compliance with drawings and specifications.

Include electrical ratings, dimensions, mounting details, materials, enclosure types, and fuse types and classes.

Show the specific switch and fuse proposed for each specific piece of equipment or circuit.

C. Manuals:

Provide complete maintenance and operating manuals for disconnect switches, including technical data sheets, wiring diagrams, and information for ordering replacement parts. Deliver four copies to the COTR two weeks prior to final inspection.

Terminals on wiring diagrams shall be identified to facilitate maintenance and operation.

3. Wiring diagrams shall indicate internal wiring and any interlocking.
D. Certifications: Two weeks prior to the final inspection, submit four copies of the following certifications to the COTR:

- 1. Certification by the manufacturer that the materials conform to the requirements of the drawings and specifications.
- 2. Certification by the contractor that the materials have been properly installed, connected, and tested.

1.5 APPLICABLE PUBLICATIONS

Publications listed below (including amendments, addenda, revisions, supplements, and errata) form a part of this specification to the extent referenced. Publications are referenced in the text by designation only.

National Electrical Manufacturers Association (NEMA):

- FU 1-07Low Voltage Cartridge Fuses
- KS 1-06Enclosed and Miscellaneous Distribution
Equipment Switches (600 Volts Maximum)

National Fire Protection Association (NFPA):

- 70-08 National Electrical Code (NEC)

Underwriters Laboratories, Inc. (UL):

- 98-04Enclosed and Dead-Front Switches
- 248-00Low Voltage Fuses
- 977-94Fused Power-Circuit Devices

PART 2 - PRODUCTS

2.1 LOW VOLTAGE FUSIBLE SWITCHES RATED 600 AMPERES AND LESS

In accordance with UL 98, NEMA KS1, and NEC.
 Shall have NEMA classification General Duty (GD) for 240 V switches and
 NEMA classification Heavy Duty (HD) for 480 V switches.
 Shall be HP rated.

Shall have the following features:

- Switch mechanism shall be the quick-make, quick-break type.
- Copper blades, visible in the OFF position.
- An arc chute for each pole.
- External operating handle shall indicate ON and OFF position and have lock-open padlocking provisions.
- Mechanical interlock shall permit opening of the door only when the switch is in the OFF position, defeatable to permit inspection.
- Fuse holders for the sizes and types of fuses specified.
- Solid neutral for each switch being installed in a circuit which includes a neutral conductor.
- Ground lugs for each ground conductor.

9. Enclosures:

Shall be the NEMA types shown on the drawings for the switches.

Where the types of switch enclosures are not shown, they shall be the NEMA types most suitable for the ambient environmental conditions. Unless otherwise indicated on the plans, all outdoor switches shall be NEMA 3R.

Shall be finished with manufacturer's standard gray baked enamel paint over pretreated steel (for the type of enclosure required). **2.2 LOW VOLTAGE UNFUSED SWITCHES RATED 600 AMPERES AND LESS**

Shall be the same as Low Voltage Fusible Switches Rated 600 Amperes and Less, but without provisions for fuses.

2.4 MOTOR RATED TOGGLE SWITCHES

Refer to Section 26 29 11, LOW-VOLTAGE MOTOR STARTERS.

2.5 LOW VOLTAGE CARTRIDGE FUSES

In accordance with NEMA FU1.

Service Entrance: Class L, time delay.

Feeders: Class RK1, time delay.

DB. Motor Branch Circuits: Class RK1, time delay.

Control Circuits: Class CC, fast acting time delay.

PART 3 - EXECUTION

3.1 INSTALLATION

Install disconnect switches in accordance with the NEC and as shown on the drawings.

Fusible disconnect switches shall be furnished complete with fuses.

Arrange fuses such that rating information is readable without removing the fuse.

3.2 SPARE PARTS

Two weeks prior to the final inspection, furnish one complete set of spare fuses for each fusible disconnect switch installed on the project. Deliver the spare fuses to the COTR.

- - - E N D - - -

THIS PAGE INTENTIONALLY LEFT BLANK

SECTION 26 43 13
TRANSIENT-VOLTAGE SURGE SUPPRESSION

PART 1 - GENERAL

1.1 DESCRIPTION

Section includes transient voltage surge suppression equipment for low-voltage power distribution and control equipment.

1.2 RELATED WORK

Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS: General requirements that are common to more than one section of Division 26.

Section 26 23 00, LOW-VOLTAGE SWITCHGEAR: For factory-installed TVSS.

Section 26 24 11, DISTRIBUTION SWITCHBOARDS: For factory-installed TVSS.

Section 26 24 16, PANELBOARDS: For factory-installed TVSS.

1.3 QUALITY ASSURANCE

Refer to Paragraph, QUALIFICATIONS, in Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS.

1.4 SUBMITTALS

Include rated capacities, operating weights, electrical characteristics, furnished specialties, and accessories.

Operation and Maintenance Data: For TVSS devices to include in emergency, operation, and maintenance manuals.

Warranties: Sample of special warranties.

Certifications:

1. Two weeks prior to final inspection, submit four copies of the following to the COTR:

Certification by the Contractor that the assemblies have been properly installed, adjusted and tested.

Certified copies of all of the factory design and production tests, field test data sheets and reports for the assemblies.

1.5 APPLICABLE PUBLICATIONS

Publications listed below (including amendments, addenda, revisions, supplement and errata) form a part of this specification to the extent referenced. Publications are referenced in the text by the basic designation only.

A. Institute of Engineering and Electronic Engineers (IEEE):

IEEE C62.41.2 Recommended Practice on Characterization of Surges in Low-Voltage (1000 V and Less) AC Power Circuits

IEEE C62.45 Recommended Practice on Surge Testing for
Equipment Connected to Low-Voltage (1000
V and Less) AC Power Circuits

National Electrical Manufacturers Association (NEMA):

NEMA LS 1 Low Voltage Surge Protective Devices

Underwriters Laboratories, Inc. (UL):

UL 1283 Electromagnetic Interference Filters

UL 1449 Surge Protective Devices

National Fire Protection Association (NFPA):

NFPA 70 National Electrical Code (NEC)

PART 2 - PRODUCTS

2.1 SWITCHGEAR/SWITCHBOARD SUPPRESSORS

A. Surge Protection Devices:

Comply with UL 1449.

Modular design with field-replaceable modules.

Fuses, rated at 200-kA interrupting capacity.

Fabrication using bolted compression lugs for internal wiring.

Integral disconnect switch.

Redundant suppression circuits.

Redundant replaceable modules.

Arrangement with copper bus bars and for bolted connections to phase
buses, neutral bus, and ground bus.

Arrangement with wire connections to phase buses, neutral bus, and
ground bus.

LED indicator lights for power and protection status.

Audible alarm, with silencing switch, to indicate when protection
has failed.

Form-C contacts rated at 5 A and 250-V ac, one normally open and one
normally closed, for remote monitoring of protection status.

Contacts shall reverse on failure of any surge diversion module or
on opening of any current-limiting device. Coordinate with building
power monitoring and control system.

Four-digit transient-event counter set to totalize transient surges.

B. Peak Single-Impulse Surge Current Rating: 240 kA per mode/480 kA per phase.

C. Minimum single impulse current ratings, using 8-by-20-mic.sec waveform described in IEEE C62.41.2

1. Line to Neutral: 70,000 A.

Line to Ground: 70,000 A.

Neutral to Ground: 50,000 A.

- D. Protection modes and UL 1449 SVR for grounded wye circuits shall be as follows:

Line to Neutral: 800 V for 480Y/277 V, 400 V for 208Y/120 V.

Line to Ground: 800 V for 480Y/277 V, 400 V for 208Y/120 V.

Neutral to Ground: 800 V for 480Y/277 V, 400 V for 208Y/120 V.

- E. Protection modes and UL 1449 SVR for 240/120 V, single-phase, 3-wire circuits shall be as follows:

Line to Neutral: 400 V.

Line to Ground: 400 V.

Neutral to Ground: 400 V.

- F. Protection modes and UL 1449 SVR for 240/120-V, 3-phase, 4-wire circuits with high leg shall be as follows:

Line to Neutral: 400 V, 800 V from high leg.

Line to Ground: 400 V.

Neutral to Ground: 400 V.

- G. Protection modes and UL 1449 SVR for 240 V or 480 V, 3-phase, 3-wire, delta circuits shall be as follows:

Line to Line: 2000 V for 480 V, 1000 V for 240 V.

Line to Ground: 2000 V for 480 V, 1000 V for 240 V.

2.2 PANELBOARD SUPPRESSORS

- A. Surge Protection Devices:

Non-modular.

LED indicator lights for power and protection status.

Audible alarm, with silencing switch, to indicate when protection has failed.

- B. Peak Single-Impulse Surge Current Rating: 160 kA per mode/320 kA per phase.

- C. Minimum single impulse current ratings, using 8-by-20-mic.sec waveform described in IEEE C62.41.2:

Line to Neutral: 70,000 A.

Line to Ground: 70,000 A.

Neutral to Ground: 50,000 A.

- D. Protection modes and UL 1449 SVR for grounded wye circuits shall be as follows:

Line to Neutral: 800 V for 480Y/277 V, 400 V for 208Y/120 V.

Line to Ground: 800 V for 480Y/277 V, 400 V for 208Y/120 V.

3. Neutral to Ground: 800 V for 480Y/277 V, 400 V for 208Y/120 V.
- E. Protection modes and UL 1449 SVR for 240/120-V, single-phase, 3-wire circuits shall be as follows:
- Line to Neutral: 400 V.
 - Line to Ground: 400 V.
 - Neutral to Ground: 400 V.
- F. Protection modes and UL 1449 SVR for 240/120-V, 3-phase, 4-wire circuits with high leg shall be as follows:
- Line to Neutral: 400 V, 800 V from high leg.
 - Line to Ground: 400 V.
 - Neutral to Ground: 400 V.
- G. Protection modes and UL 1449 SVR for 240 V or 480 V, 3-phase, 3-wire, delta circuits shall be as follows:
1. Line to Line: 2000 V for 480 V, 1000 V for 240 V.
 2. Line to Ground: 1500 V for 480 V, 800 V for 240 V.

2.3 ENCLOSURES

- Indoor Enclosures: NEMA 250 Type 1.
- Outdoor Enclosures: NEMA 250 Type 3R.

PART 3 - EXECUTION

3.1 INSTALLATION

Install TVSS devices at switchboard, switchgear, or panelboard on load side, with ground lead bonded to service entrance ground.

Install TVSS devices for panelboards and auxiliary panels with conductors or buses between suppressor and points of attachment as short and straight as possible. Do not exceed manufacturer's recommended lead length. Do not bond neutral and ground.

1. Provide a circuit breaker, sized by manufacturer, as a dedicated disconnecting means for TVSS unless otherwise shown on drawings.

3.2 ACCEPTANCE CHECKS AND TESTS

- A. Perform in accordance with the manufacturer's recommendations. Include the following visual and mechanical inspections and electrical tests:

1. Visual and Mechanical Inspection

- Compare equipment nameplate data with specifications and approved shop drawings.

- Inspect physical, electrical, and mechanical condition.

- Verify that disconnecting means and feeder size and maximum to TVSS unit correspond to approved shop drawings.

Verifying tightness of accessible bolted electrical connections by calibrated torque-wrench method.

Clean TVSS unit.

Complete startup checks according to manufacturer's written instructions.

Verify the correct operation of all sensing devices, alarms, and indicating devices.

3.3 STARTUP

Do not energize or connect switchgear, switchboards, or panelboards to their sources until TVSS devices are installed and connected.

Do not perform insulation resistance tests of the distribution wiring equipment with the TVSS installed. Disconnect before conducting insulation resistance tests, and reconnect immediately after the testing is over.

3.4 SPARE PARTS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Replaceable Protection Modules: One of each size and type installed.

3.5 INSTRUCTION

Provide factory certified technician to train Government maintenance personnel to maintain TVSS devices. Training shall be provided for a total period of 4 hours of normal working time and shall start after the system is functionally complete but prior to final acceptance test. Training shall cover all essential items contained in the operation and maintenance manual.

- - -END OF SECTION - - -

THIS PAGE INTENTIONALLY LEFT BLANK

**SECTION 26 51 00
INTERIOR LIGHTING**

PART 1 - GENERAL

1.1 DESCRIPTION:

This section specifies the furnishing, installation and connection of the interior lighting systems.

1.2 RELATED WORK

Section 13 05 41, SEISMIC RESTRAINT REQUIREMENTS FOR NON-STRUCTURAL COMPONENTS: Requirement for seismic restraint for nonstructural Components.

Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS: General requirements that are common to more than one section of Division 26.

Section 26 05 21, LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES (600 VOLTS AND BELOW): Cables and wiring.

Section 26 05 26, GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS:

Requirements for personnel safety and to provide a low impedance path to ground for possible ground fault currents.

Section 26 27 26, WIRING DEVICES: Wiring devices used for control of the lighting systems.

1.3 QUALITY ASSURANCE

Refer to Paragraph, QUALIFICATIONS, in Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS.

1.4 SUBMITTALS

In accordance with Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS, submit the following:

Product Data: For each type of lighting fixture (luminaire) designated on the LIGHTING FIXTURE SCHEDULE, arranged in order of fixture designation, submit the following information.

Material and construction details include information on housing, optics system and lens/diffuser.

Physical dimensions and description.

Wiring schematic and connection diagram.

Installation details.

Energy efficiency data.

Photometric data based on laboratory tests complying with IESNA Lighting Measurements, testing and calculation guides.

Lamp data including lumen output (initial and mean), color rendition index (CRI), rated life (hours) and color temperature (degrees Kelvin).

8. Ballast data including ballast type, starting method, ambient temperature, ballast factor, sound rating, system watts and total harmonic distortion (THD).

C. Manuals:

Submit, simultaneously with the shop drawings companion copies of complete maintenance and operating manuals including technical data sheets, and information for ordering replacement parts.

Two weeks prior to the final inspection, submit four copies of the final updated maintenance and operating manuals, including any changes, to the COTR.

D. Certifications:

1. Two weeks prior to final inspection, submit four copies of the following certifications to the COTR:

a. Certification by the Contractor that the equipment has been properly installed, adjusted, and tested.

1.5 APPLICABLE PUBLICATIONS

Publications listed below (including amendments, addenda, revisions, supplements, and errata) form a part of this specification to the extent referenced. Publications are referenced in the text by designation only.

Institute of Electrical and Electronic Engineers (IEEE):

C62.41-91 Guide on the Surge Environment in Low Voltage
(1000V and less) AC Power Circuits

National Fire Protection Association (NFPA):

70 National Electrical Code (NEC)

101 Life Safety Code

National Electrical Manufacturer's Association (NEMA):

C82.1-97 Ballasts for Fluorescent Lamps - Specifications

C82.2-02 Method of Measurement of Fluorescent Lamp
Ballasts

C82.4-02 Ballasts for High-Intensity-Discharge and Low-
Pressure Sodium Lamps

C82.11-02 High Frequency Fluorescent Lamp Ballasts

Underwriters Laboratories, Inc. (UL):

496-96 Edison-Base Lampholders

542-99 Lampholders, Starters, and Starter Holders for
Fluorescent Lamps

844-95 Electric Lighting Fixtures for Use in Hazardous
(Classified) Locations

924-95 Emergency Lighting and Power Equipment

935-01	Fluorescent-Lamp Ballasts
1029-94	High-Intensity-Discharge Lamp Ballasts
1029A-06	Ignitors and Related Auxiliaries for HID Lamp Ballasts
1598-00	Luminaires
1574-04	Standard for Track Lighting Systems
2108-04	Standard for Low-Voltage Lighting Systems
8750-08	Light Emitting Diode (LED) Light Sources for Use in Lighting Products

F. Federal Communications Commission (FCC):

Code of Federal Regulations (CFR), Title 47, Part 18

PART 2 - PRODUCTS

2.1 LIGHTING FIXTURES (LUMINAIRES)

A. Shall be in accordance with NFPA 70 and UL 1598, as shown on drawings, and as specified.

B. Sheet Metal:

Shall be formed to prevent warping and sagging. Housing, trim and lens frame shall be true, straight (unless intentionally curved) and parallel to each other as designed.

Wireways and fittings shall be free of burrs and sharp edges and shall accommodate internal and branch circuit wiring without damage to the wiring.

When installed, any exposed fixture housing surface, trim frame, door frame and lens frame shall be free of light leaks; lens doors shall close in a light tight manner.

Hinged door closure frames shall operate smoothly without binding when the fixture is in the installed position, latches shall function easily by finger action without the use of tools.

C. Ballasts shall be serviceable while the fixture is in its normally installed position, and shall not be mounted to removable reflectors or wireway covers unless so specified.

D. Lamp Sockets:

Fluorescent: Lampholder contacts shall be the biting edge type or phosphorous-bronze with silver flash contact surface type and shall conform to the applicable requirements of UL 542. Lamp holders for bi-pin lamps shall be of the telescoping compression type, or of the single slot entry type requiring a one-quarter turn of the lamp after insertion.

High Intensity Discharge (H.I.D.): Shall have porcelain enclosures.

- E. Recessed fixtures mounted in an insulated ceiling shall be listed for use in insulated ceilings.
- F. Mechanical Safety: Lighting fixture closures (lens doors, trim frame, hinged housings, etc.) shall be retained in a secure manner by captive screws, chains, captive hinges or fasteners such that they cannot be accidentally dislodged during normal operation or routine maintenance.
- G. Metal Finishes:
The manufacturer shall apply standard finish (unless otherwise specified) over a corrosion resistant primer, after cleaning to free the metal surfaces of rust, grease, dirt and other deposits. Edges of pre-finished sheet metal exposed during forming, stamping or shearing processes shall be finished in a similar corrosion resistant manner to match the adjacent surface(s). Fixture finish shall be free of stains or evidence of rusting, blistering, or flaking, and shall be applied after fabrication.
Interior light reflecting finishes shall be white with not less than 85 percent reflectances, except where otherwise shown on the drawing.
Exterior finishes shall be as shown on the drawings.
- H. Lighting fixtures shall have a specific means for grounding metallic wireways and housings to an equipment grounding conductor.
- I. Light Transmitting Components for Fluorescent Fixtures:
Shall be 100 percent virgin acrylic.
Flat lens panels shall have not less than 1/8 inch [3.2mm] of average thickness. The average thickness shall be determined by adding the maximum thickness to the minimum unpenetrated thickness and dividing the sum by 2.
Unless otherwise specified, lenses, diffusers and louvers shall be retained firmly in a metal frame by clips or clamping ring in such a manner as to allow expansion and contraction of the lens without distortion or cracking.
- J. Lighting fixtures in hazardous areas shall be suitable for installation in Class and Group areas as defined in NFPA 70, and shall comply with UL 844.
- K. Compact fluorescent fixtures shall be manufactured specifically for compact fluorescent lamps with ballast integral to the fixture. Assemblies designed to retrofit incandescent fixtures are prohibited except when specifically indicated for renovation of existing fixtures (not the lamp). Fixtures shall be designed for lamps as specified.

2.2 BALLASTS

- A. Linear Fluorescent Lamp Ballasts: Multi-voltage (120 - 277V) electronic instant-start, programmed-start type, complying with UL 935 and with ANSI C 82.11, designed for type and quantity of lamps indicated. Ballast shall be designed for full light output unless dimmer or bi-level control is indicated; including the following features:
- Lamp end-of-life detection and shutdown circuit (T5 lamps only).
 - Automatic lamp starting after lamp replacement.
 - Sound Rating: Class A.
 - Total Harmonic Distortion Rating: 10 percent or less.
 - Transient Voltage Protection: IEEE C62.41.1 and IEEE C62.41.2, Category A or better.
 - Operating Frequency: 20 kHz or higher.
 - Lamp Current Crest Factor: 1.7 or less.
 - Ballast Factor: 0.87 or higher unless otherwise indicated.
 - Power Factor: 0.98 or higher.
 - Interference: Comply with 47 CFT 18, Ch.1, Subpart C, for limitations on electromagnetic and radio-frequency interference for non-consumer equipment.
- To facilitate multi-level lamp switching, lamps within fixture shall be wired with the outermost lamp at both sides of the fixture on the same ballast, the next inward pair on another ballast and so on to the innermost lamp (or pair of lamps). Within a given room, each switch shall uniformly control the same corresponding lamp (or lamp pairs) in all fixture units that are being controlled.
- Where three-lamp fixtures are indicated, unless switching arrangements dictate otherwise, utilize a common two-lamp ballast to operate the center lamp in pairs of adjacent units that are mounted in a continuous row. The ballast fixture and slave-lamp fixture shall be factory wired with leads or plug devices to facilitate this circuiting. Individually mounted fixtures and the odd fixture in a row shall utilize a single-lamp ballast for operation of the center lamp.
- Dimming ballasts shall be as per above, except dimmable from 100% to 10% of rated lamp lumens.

- B. Compact Fluorescent Lamp Ballasts: Multi-voltage (120 - 277V), electronic-programmed rapid-start type, complying with UL 935 and with ANSI C 82.11, designed for type and quantity of lamps indicated. Ballast shall be designed for full light output unless dimmer or bi-level control is indicated; including the following features:
Lamp end-of-life detection and shutdown circuit.
Automatic lamp starting after lamp replacement.
Sound Rating: Class A.
Total Harmonic Distortion Rating: 10 percent or less.
Transient Voltage Protection: IEEE C62.41.1 and IEEE C62.41.2, Category A or better.
Operating Frequency: 20 kHz or higher.
Lamp Current Crest Factor: 1.7 or less.
Ballast Factor: 0.95 or higher unless otherwise indicated.
Power Factor: 0.98 or higher.
Interference: Comply with 47 CFR 18, Ch. 1, Subpart C, for limitations on electromagnetic and radio-frequency interference for non-consumer equipment.
Dimming ballasts shall be as per above, except dimmable from 100% to 10% of rated lamp lumens.
- D. Ballasts for high intensity discharge fixtures: Multi-tap voltage (120-480v) electromagnetic ballast for high intensity discharge lamps. Comply with ANSI C82.4 and UL 1029. Include the following features unless otherwise indicated:
Ballast Circuit: Constant-wattage autotransformer or regulating high-power-factor type.
Minimum Starting Temperature: Minus 22 deg F (Minus 30 deg C) for single-lamp ballasts.
Rated Ambient Operating Temperature: 104 deg F (40 deg C).
Open-circuit operation that will not reduce average life.
Low-Noise Ballasts: Manufacturers' standard epoxy-encapsulated models designed to minimize audible fixture noise.
- E. Electronic ballast for high intensity discharge metal-halide lamps shall include the following features unless otherwise indicated:
Minimum Starting Temperature: Minus 20 deg F (Minus 29 deg C) for single-lamp ballasts.
Rated Ambient Operating Temperature: 130 deg F (54 deg C).
Lamp end-of-life detection and shutdown circuit.
Sound Rating: Class A.

Total Harmonic Distortion Rating: 20 percent or less.
Transient Voltage Protection: IEEE C62.41.1 and IEEE C62.41.2,
Category A or better.
Lamp Current Crest Factor: 1.5 or less.
Power Factor: 0.90 or higher.

Interference: Comply with 47 CFR 18, Ch. 1, Subpart C, for limitations on electromagnetic and radio-frequency interference for non-consumer equipment.

Protection: Class P thermal cut.

2.3 LAMPS

A. Linear and U-shaped T5 and T8 Fluorescent Lamps:

Rapid start fluorescent lamps shall comply with ANSI C78.1; and instant-start lamps shall comply with ANSI C78.3.

Chromaticity of fluorescent lamps shall comply with ANSI C78.376.

Except as indicated below, lamps shall be low-mercury energy saving type, have a color temperature between 3500° and 4100°K, a Color Rendering Index (CRI) of greater than 70, average rated life of 20,000 hours, and be suitable for use with dimming ballasts, unless otherwise indicated. Low mercury lamps shall have passed the EPA Toxicity Characteristic Leachate Procedure (TCLP) for mercury by using the lamp sample preparation procedure described in NEMA LL 1. Over the beds in Intensive Care, Coronary Care, Recovery, Life Support, and Observation and Treatment areas; Electromyographic, Autopsy (Necropsy), Surgery, and certain dental rooms (Examination, Oral Hygiene, Oral Surgery, Recovery, Labs, Treatment, and X-Ray) use color corrected lamps having a CRI of 85 or above and a correlated color temperature between 5000 and 6000°K.

Other areas as indicated on the drawings.

B. Compact Fluorescent Lamps:

1. T4, CRI 80 (minimum), color temperature 3500 K, and suitable for use with dimming ballasts, unless otherwise indicated.

C. Long Twin-Tube Fluorescent Lamps:

1. T5, CRI 80 (minimum), color temperature between 3500° and 4100°K, 20,000 hours average rated life.

D. High Intensity Discharge Lamps:

Pulse-Start, Metal-Halide Lamps: Minimum CRI 65, and color temperature 4000°K.

Ceramic, Pulse-Start, Metal-Halide Lamps: CRI 80 (minimum), and color temperature 4000°K.

2.4 EXIT LIGHT FIXTURES

A. Exit light fixtures shall meet applicable requirements of NFPA 101 and UL 924.

B. Housing and Canopy:

Shall be made of die-cast aluminum.

Optional steel housing shall be a minimum 20 gauge thick or equivalent strength aluminum.

Steel housing shall have baked enamel over corrosion resistant, matte black or ivory white primer.

C. Door frame shall be cast or extruded aluminum, and hinged with latch.

D. Finish shall be satin or fine-grain brushed aluminum.

E. There shall be no radioactive material used in the fixtures.

F. Fixtures:

Maximum fixture wattage shall be 1 watt or less.

Inscription panels shall be cast or stamped aluminum a minimum of 0.090 inch [2.25mm] thick, stenciled with 6 inch [150mm] high letters, baked with red color stable plastic or fiberglass. Lamps shall be luminous Light Emitting Diodes (LED) mounted in center of letters on red color stable plastic or fiberglass. The LED shall be rated minimum 25 years life.

Double-Faced Fixtures: Provide double-faced fixtures where required or as shown on drawings.

Directional Arrows: Provide directional arrows as part of the inscription panel where required or as shown on drawings. Directional arrows shall be the "chevron-type" of similar size and width as the letters and meet the requirements of NFPA 101.

G. Voltages: Refer to Lighting Fixture Schedule.

PART 3 - EXECUTION**3.1 INSTALLATION**

Installation shall be in accordance with the NEC, manufacturer's instructions and as shown on the drawings or specified.

Align, mount and level the lighting fixtures uniformly.

Lighting Fixture Supports:

Shall provide support for all of the fixtures. Supports may be anchored to channels of the ceiling construction, to the structural slab or to structural members within a partition, or above a suspended ceiling.

Shall maintain the fixture positions after cleaning and relamping. Shall support the lighting fixtures without causing the ceiling or partition to deflect.

4. Hardware for recessed fluorescent fixtures:

Where the suspended ceiling system is supported at the four corners of the fixture opening, hardware devices shall clamp the fixture to the ceiling system structural members, or plaster frame at not less than four points in such a manner as to resist spreading of the support members and safely lock the fixture into the ceiling system.

Where the suspended ceiling system is not supported at the four corners of the fixture opening, hardware devices shall independently support the fixture from the building structure at four points.

5. Hardware for surface mounting fluorescent fixtures to suspended ceilings:

In addition to being secured to any required outlet box, fixtures shall be bolted to a grid ceiling system at four points spaced near the corners of each fixture. The bolts shall be not less than 1/4 inch [6mm] secured to channel members attached to and spanning the tops of the ceiling structural grid members. Non-turning studs may be attached to the ceiling structural grid members or spanning channels by special clips designed for the purpose, provided they lock into place and require simple tools for removal.

In addition to being secured to any required outlet box, fixtures shall be bolted to ceiling structural members at four points spaced near the corners of each fixture. Pre-positioned 1/4 inch [6mm] studs or threaded plaster inserts secured to ceiling structural members shall be used to bolt the fixtures to the ceiling. In lieu of the above, 1/4 inch [6mm] toggle bolts may be used on new or existing ceiling provided the plaster and lath can safely support the fixtures without sagging or cracking.

Furnish and install the specified lamps for all lighting fixtures installed and all existing lighting fixtures reinstalled under this project.

Coordinate between the electrical and ceiling trades to ascertain that approved lighting fixtures are furnished in the proper sizes and installed with the proper devices (hangers, clips, trim frames, flanges), to match the ceiling system being installed.

Bond lighting fixtures and metal accessories to the grounding system as specified in Section 26 05 26, GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS.

Exercise electronic dimming ballasts over full range of dimming capability by operating the control devices(s) in the presence of the COTR. Observe for visually detectable flicker over full dimming range.

Burn-in all lamps that require specific aging period to operate properly, prior to occupancy by Government. Burn-in period to be 40 hours minimum, unless a lesser period is specifically recommended by lamp manufacturer. Burn-in fluorescent and compact fluorescent lamps intended to be dimmed, for at least 100 hours at full voltage. Replace any lamps and ballasts which fail during burn-in.

At completion of project, relamp/reballast fixtures which have failed lamps/ballasts. Clean fixtures, lenses, diffusers and louvers that have accumulated dust/dirt/fingerprints during construction. Replace damaged lenses, diffusers and louvers with new.

Dispose of lamps per requirements of Section 01 74 19, CONSTRUCTION WASTE MANAGEMENT.

- - - E N D - - -

SECTION 26 56 00 EXTERIOR
LIGHTING

PART 1 - GENERAL

1.1 DESCRIPTION

This section specifies the furnishing, installation, and connection of exterior luminaires, poles, and supports.

1.2 RELATED WORK

Section 09 06 00, SCHEDULE FOR FINISHES: Finishes for exterior light poles and luminaires.

Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS: General electrical requirements and items that are common to more than one section of Division 26.

Section 26 05 21, LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES (600 VOLTS AND BELOW): Low voltage power and lighting wiring.

Section 26 05 26, GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS: Requirements for personnel safety and to provide a low impedance path for possible ground fault currents.

Section 26 05 33, RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS: Conduits, fittings, and boxes for raceway systems.

Section 26 05 41, UNDERGROUND ELECTRICAL CONSTRUCTION: Underground handholes and conduits.

1.3 QUALITY ASSURANCE

Refer to Paragraph, QUALIFICATIONS, in Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS.

1.4 SUBMITTALS

Submit in accordance with Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS.

Shop Drawings:

Clearly present sufficient information to determine compliance with drawings and specifications.

Include electrical ratings, dimensions, mounting, details, materials, required clearances, terminations, wiring and connection diagrams, photometric data, ballasts, poles, luminaires, lamps, and accessories.

Manuals: Two weeks prior to final inspection, submit four copies of operating and maintenance manuals to the COTR. Include technical data sheets, wiring and connection diagrams, and information for ordering replacement lamps, ballasts, and parts.

Certifications: Two weeks prior to final inspection, submit four copies of the following to the COTR:

Certification by the manufacturer that the materials are in accordance with the drawings and specifications.

Certification by the contractor that the complete installation has been properly installed and tested.

1.5 APPLICABLE PUBLICATIONS

Publications listed below (including amendments, addenda, revisions, supplements, and errata) form a part of this specification to the extent referenced. Publications are referenced in the text by designation only.

Aluminum Association Inc. (AA):

AAH35.1-06 Alloy and Temper Designation Systems for Aluminum

American Concrete Institute (ACI):

318-05 Building Code Requirements for Structural Concrete

American National Standards Institute (ANSI):

C81.61-09 Electrical Lamp Bases - Specifications for Bases (Caps) for Electric Lamps

American Society for Testing and Materials (ASTM):

A123/A123M-09 Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products

A153/A153M-09 Zinc Coating (Hot-Dip) on Iron and Steel Hardware

B108-03a-08 Aluminum-Alloy Permanent Mold Castings

C1089-06 Spun Cast Prestressed Concrete Poles

Illuminating Engineering Society of North America (IESNA)

HB-9-00 Lighting Handbook

RP-8-05 Roadway Lighting

RP-20-98 Lighting for Parking Facilities

RP-33-99 Lighting for Exterior Environments

LM-5-96 Photometric Measurements of Area and Sports Lighting Installations

- LM-50-99Photometric Measurements of Roadway Lighting Installations
- LM-52-99 Photometric Measurements of Roadway Sign Installations
- LM-64-01Photometric Measurements of Parking Areas
- LM-72-97Directional Positioning of Photometric Data
- LM-79-08Approved Method for the Electrical and Photometric Measurements of Solid-State Lighting Products
- LM-80-08Approved Method for Measuring Lumen Maintenance of LED Light Sources
- National Electrical Manufacturers Association (NEMA):
- C78.41-06 Electric Lamps - Guidelines for Low-Pressure Sodium Lamps
- C78.42-07 Electric Lamps - Guidelines for High-Pressure Sodium Lamps
- C78.43-07 Electric Lamps - Single-Ended Metal-Halide Lamps
- C78.1381-98 Electric Lamps - 70-Watt M85 Double-Ended Metal-Halide Lamps
- C82.4-02 Ballasts for High-Intensity-Discharge and Low-Pressure Sodium Lamps (Multiple-Supply Type)
- C136.3-05 For Roadway and Area Lighting Equipment - Luminaire Attachments
- C136.17-05 Roadway and Area Lighting Equipment - Enclosed Side-Mounted Luminaires for Horizontal-Burning High-Intensity-Discharge Lamps - Mechanical Interchangeability of Refractors
- ICS 2-00 (R2005) Controllers, Contactors and Overload Relays Rated 600 Volts
- ICS 6-93 (R2006)Enclosures
- National Fire Protection Association (NFPA):
- 70-08 National Electrical Code (NEC)
- Underwriters Laboratories, Inc. (UL):
- 496-08 Lampholders
- 773-95Plug-In, Locking Type Photocontrols for Use with Area Lighting

773A-06	.....	Nonindustrial Photoelectric Switches for Lighting Control
1029-94	.....	High-Intensity-Discharge Lamp Ballasts
1598-08	.....	Luminaires
8750-08	.....	Light Emitting Diode (LED) Light Sources for Use in Lighting Products

1.6 DELIVERY, STORAGE, AND HANDLING

Provide manufacturer's standard provisions for protecting pole finishes during transport, storage, and installation. Do not store poles on ground. Store poles so they are at least 12 in [305 mm] above ground level and growing vegetation. Do not remove factory-applied pole wrappings until just before installing pole.

PART 2 - PRODUCTS

2.1 MATERIALS AND EQUIPMENT

Materials and equipment shall be in accordance with NEC, UL, ANSI, and as shown on the drawings and specified.

2.2 POLES

A. General:

Poles shall be as shown on the drawings, and as specified. Finish shall be as specified on the drawings.

The pole and arm assembly shall be designed for wind loading of 95 mph, with an additional 30% gust factor, supporting luminaire(s) and accessories such as shields, banner arms, and banners that have the effective projected areas indicated. The effective projected area of the pole shall be applied at the height of the pole base, as shown on the drawings.

Poles shall be anchor-bolt type designed for use with underground supply conductors. Poles shall have handhole having a minimum clear opening of 2.5 x 5 in [65 x 125 mm]. Handhole covers shall be secured by stainless steel captive screws.

Provide a steel-grounding stud opposite handhole openings, designed to prevent electrolysis when used with copper wire.

Provide a base cover that matches the pole in material and color to conceal the mounting hardware pole-base welds and anchor bolts.

Hardware and Accessories: All necessary hardware and specified accessories shall be the product of the pole manufacturer.

7. Provide manufacturer's standard finish, as scheduled on the drawings. Where indicated on drawings, provide finishes as indicated in Section 09 06 00, SCHEDULE FOR FINISHES.

B. Types:

1. Aluminum: Provide round aluminum poles manufactured of corrosion-resistant AA AAH35.1 aluminum alloys conforming to AASHTO LTS-4. Poles shall be seamless extruded or spun seamless type.

2.3 FOUNDATIONS FOR POLES

Foundations shall be cast-in-place concrete, having 3000 psi minimum 28-day compressive strength.

Foundations shall support the effective projected area of the specified pole, arm(s), luminaire(s), and accessories, such as shields, banner arms, and banners, under wind conditions previously specified in this section.

Place concrete in spirally-wrapped treated paper forms for round foundations, and construct forms for square foundations.

Rub-finish and round all above-grade concrete edges to approximately 0.25 in [6 mm] radius.

Anchor bolt assemblies and reinforcing of concrete foundations shall be as shown on the drawings. Anchor bolts shall be in a welded cage or properly positioned by the tiewire to stirrups.

Prior to concrete pour, install electrode per Section 26 05 26, GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS.

2.4 LUMINAIRES

Per UL 1598 and NEMA C136.17. Luminaires shall be weatherproof, heavy duty, outdoor types designed for efficient light utilization, adequate dissipation of lamp and ballast heat, and safe cleaning and relamping.

Light distribution pattern types shall be as shown on the drawings.

Incorporate ballasts in the luminaire housing, except where otherwise shown on the drawings.

Lenses shall be frame-mounted, heat-resistant, borosilicate glass, with prismatic refractors, unless otherwise shown on the drawings. Attach the frame to the luminaire housing by hinges or chain. Use heat and aging-resistant, resilient gaskets to seal and cushion lenses and refractors in luminaire doors.

Lamp sockets for high intensity discharge (H.I.D) fixture shall have locking-type porcelain enclosures in conformance to the applicable requirements of ANSI C81.61 and UL 496.

Pre-wire internal components to terminal strips at the factory.
Bracket-mounted luminaires shall have leveling provisions and clamp-type adjustable slip-fitters with locking screws.
Materials shall be rustproof. Latches and fittings shall be non-ferrous metal.
Provide manufacturer's standard finish, as scheduled on the drawings.
Where indicated on drawings, match finish process and color of pole or support materials. Where indicated on drawings, provide finishes as indicated in Section 09 06 00, SCHEDULE FOR FINISHES.
Luminaires shall carry factory labels, showing complete, specific lamp and ballast information.

2.5 LAMPS

Install the proper lamps in every luminaire installed.
Lamps shall be general-service, outdoor lighting types.
Currently: 250W (HPS) or use LED.
LED sources shall meet the following requirements:
Operating temperature rating shall be between -40• F [-40• C] and 120• F [50• C].
Correlated Color Temperature (CCT): 4000K.
Color Rendering Index (CRI): ≥ 65 .
The manufacturer shall have performed JEDEC (Joint Electron Devices Engineering Council) reliability tests on the LEDs as follows: High Temperature Operating Life (HTOL), Room Temperature Operating Life (RTOL), Low Temperature Operating Life (LTOL), Powered Temperature Cycle (PTMCL), Non-Operating Thermal Shock (TMSK), Mechanical Shock Variable Vibration Frequency, and Solder Heat Resistance (SHR). G. Mercury vapor lamps shall not be used.

2.6 HIGH INTENSITY DISCHARGE BALLASTS

Per NEMA C82.4 and UL 1029. Ballasts shall be encapsulated single-lamp, copper-wound, constant-wattage autotransformer type, designed to operate on the voltage system to which they are connected, and capable of open-circuit operation without reducing lamp life.
Ballasts shall have individual overcurrent protection in each ungrounded supply conductor.
Ballast shall have an allowable line voltage variations of $\pm 10\%$, with a maximum 20% lamp wattage regulation spread.
Power factor shall be not less than 90%.

Ballast shall have a minimum starting temperature of -22• F [-30• C],
and a normal ambient operating temperature of 104• F [40• C].

Lamp current crest factor shall be 1.8 or less, in accordance
with lamp manufacturer recommendations. **2.7 METAL HALIDE**

ELECTRONIC BALLASTS

Ballast shall be low-frequency electronic type, and shall operate pulse
start and ceramic metal halide lamps at a frequency of 90 to 200 Hz
square wave.

Ballast shall be labeled Type '1' outdoor, suitable for recessed use,
Class 'P'.

Ballast shall have auto-resetting thermal protector to shut off ballast
when operating temperatures reach unacceptable levels.

Ballast shall have an end of lamp life detection and shut-down circuit.

Lamp current crest factor shall be 1.5 or less.

Ballasts shall comply with FCC Title 47 CFR Part 18 Non-consumer
RFI/EMI Standards.

Ballast shall have a minimum ballast factor of 1.0.

Input current THD shall not exceed 20% for the primary lamp.

Ballasts shall have ANSI C62.41, category 'A' transient protection.

Ballasts shall have power factor greater than 90%.

Ballast shall have a Class 'A' sound rating.

2.8 LED DRIVERS

A. LED drivers shall meet the following requirements:

Drivers shall have a minimum efficiency of 85%.

Starting Temperature: -40• F [-40• C].

Input Voltage: 120 to 480 (±10%) V.

Power Supplies: Class I or II output.

Surge Protection: The system must survive 250 repetitive strikes of "C
Low" (C Low: 6kV/1.2 x 50 •s, 10kA/8 x 20 •s) waveforms at 1-minute
intervals with less than 10% degradation in clamping voltage. "C Low"
waveforms are as defined in IEEE/ASNI C62.41.2-2002,
Scenario 1 Location Category C.

Power Factor (PF): • 0.90.

Total Harmonic Distortion (THD): • 20%.

Comply with FCC Title 47 CFR Part 18 Non-consumer RFI/EMI Standards.

Drivers shall be reduction of hazardous substances (ROHS)-compliant.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install lighting in accordance with the NEC, as shown on the drawings, and in accordance with manufacturer's recommendations.

B. Pole Foundations:

Excavate only as necessary to provide sufficient working clearance for installation of forms and proper use of tamper to the full depth of the excavation. Prevent surface water from flowing into the excavation. Thoroughly compact backfill with compacting arranged to prevent pressure between conductor, jacket, or sheath, and the end of conduit.

Set anchor bolts according to anchor-bolt templates furnished by the pole manufacturer.

Install poles as necessary to provide a permanent vertical position with the bracket arm in proper position for luminaire location.

After the poles have been installed, shimmed, and plumbed, grout the spaces between the pole bases and the concrete base with non-shrink concrete grout material. Provide a plastic or copper tube, of not less than 0.375 in [9 mm] inside diameter through the grout, tight to the top of the concrete base to prevent moisture weeping from the interior of the pole.

C. Install lamps in each luminaire.

D. Adjust luminaires that require field adjustment or aiming.

3.2 GROUNDING

Ground noncurrent-carrying parts of equipment, including metal poles, luminaires, mounting arms, brackets, and metallic enclosures, as specified in Section 26 05 26, GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS. Where copper grounding conductor is connected to a metal other than copper, provide specially-treated or lined connectors suitable and listed for this purpose.

3.3 ACCEPTANCE CHECKS AND TESTS

Verify operation after installing luminaires and energizing circuits.

- - - E N D - - -

SECTION 27 05 11
REQUIREMENTS FOR COMMUNICATIONS INSTALLATIONS

PART 1 - GENERAL

1.1 DESCRIPTION

This Section, Requirements for Communications Installations, applies to all sections of Division 27.

Furnish and install communications cabling, systems, equipment, and accessories in accordance with the specifications and drawings. Capacities and ratings of cable and other items and arrangements for the specified items are shown on drawings.

1.2 MINIMUM REQUIREMENTS

References to industry and trade association standards and codes are minimum installation requirement standards.

Drawings and other specification sections shall govern in those instances where requirements are greater than those specified in the above standards.

1.3 QUALIFICATIONS (PRODUCTS AND SERVICES)

A. **Manufacturers Qualifications:** The manufacturer shall regularly and presently produce, as one of the manufacturer's principal products, the equipment and material specified for this project, and shall have manufactured the item for at least three years.

B. **Product Qualification:**

Manufacturer's product shall have been in satisfactory operation, on three installations of similar size and type as this project, for approximately three years.

The Government reserves the right to require the Contractor to submit a list of installations where the products have been in operation before approval.

C. **Service Qualifications:** There shall be a permanent service organization maintained or trained by the manufacturer which will render satisfactory service to this installation within four hours of receipt of notification that service is needed. Submit name and address of service organizations.

1.4 MANUFACTURED PRODUCTS

A. **Materials and equipment furnished shall be of current production by manufacturers regularly engaged in the manufacture of such items, for which replacement parts shall be available.**

B. When more than one unit of the same class of equipment is required, such units shall be the product of a single manufacturer.

C. Equipment Assemblies and Components:

Components of an assembled unit need not be products of the same manufacturer.

Manufacturers of equipment assemblies, which include components made by others, shall assume complete responsibility for the final assembled unit.

Components shall be compatible with each other and with the total assembly for the intended service.

Constituent parts which are similar shall be the product of a single manufacturer.

D. Factory wiring shall be identified on the equipment being furnished and on all wiring diagrams.

E. When Factory Testing Is Specified:

The Government shall have the option of witnessing factory tests. The contractor shall notify the VA through the COTR a minimum of 15 working days prior to the manufacturers making the factory tests.

Four copies of certified test reports containing all test data shall be furnished to the COTR prior to final inspection and not more than 90 days after completion of the tests.

When equipment fails to meet factory test and re-inspection is required, the contractor shall be liable for all additional expenses, including expenses of the Government.

1.5 EQUIPMENT REQUIREMENTS

Where variations from the contract requirements are requested in accordance with the GENERAL CONDITIONS and Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES, the connecting work and related components shall include, but not be limited to additions or changes to branch circuits, circuit protective devices, conduits, wire, feeders, controls, panels and installation methods.

1.6 EQUIPMENT PROTECTION

A. Equipment and materials shall be protected during shipment and storage against physical damage, dirt, moisture, cold and rain:

During installation, enclosures, equipment, controls, controllers, circuit protective devices, and other like items, shall be protected against entry of foreign matter; and be vacuum cleaned both inside and outside before testing and operating and repainting if required.

Damaged equipment shall be, as determined by the COTR, placed in first class operating condition or be returned to the source of supply for repair or replacement.

Painted surfaces shall be protected with factory installed removable heavy kraft paper, sheet vinyl or equal.

Damaged paint on equipment and materials shall be refinished with the same quality of paint and workmanship as used by the manufacturer so repaired areas are not obvious.

1.7 WORK PERFORMANCE

Job site safety and worker safety is the responsibility of the contractor.

For work on existing stations, arrange, phase and perform work to assure communications service for other buildings at all times. Refer to Article OPERATIONS AND STORAGE AREAS under Section 01 00 00, GENERAL REQUIREMENTS.

New work shall be installed and connected to existing work neatly and carefully. Disturbed or damaged work shall be replaced or repaired to its prior conditions, as required by Section 01 00 00, GENERAL REQUIREMENTS.

Coordinate location of equipment and pathways with other trades to minimize interferences. See the GENERAL CONDITIONS.

1.8 EQUIPMENT INSTALLATION AND REQUIREMENTS

Equipment location shall be as close as practical to locations shown on the drawings.

Inaccessible Equipment:

Where the Government determines that the Contractor has installed equipment not conveniently accessible for operation and maintenance, the equipment shall be removed and reinstalled as directed at no additional cost to the Government.

"Conveniently accessible" is defined as being capable of being reached without the use of ladders, or without climbing or crawling under or over obstacles such as, but not limited to, motors, pumps, belt guards, transformers, piping, ductwork, conduit and raceways.

1.9 EQUIPMENT IDENTIFICATION

Install an identification sign which clearly indicates information required for use and maintenance of equipment.

Nameplates shall be laminated black phenolic resin with a white core with engraved lettering, a minimum of 6 mm (1/4 inch) high. Secure nameplates with screws. Nameplates that are furnished by manufacturer as a standard catalog item, or where other method of identification is herein specified, are exceptions.

1.10 SUBMITTALS

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, and SAMPLES.
- B. The Government's approval shall be obtained for all equipment and material before delivery to the job site. Delivery, storage, or installation of equipment or material which has not had prior approval will not be permitted at the job site.
- C. All submittals shall include adequate descriptive literature, catalog cuts, shop drawings, and other data necessary for the Government to ascertain that the proposed equipment and materials comply with specification requirements. Catalog cuts submitted for approval shall be legible and clearly identify equipment being submitted.
- D. Submittals for individual systems and equipment assemblies which consist of more than one item or component shall be made for the system or assembly as a whole. Partial submittals will not be considered for approval.

Mark the submittals, "SUBMITTED UNDER SECTION _____".
Submittals shall be marked to show specification reference including the section and paragraph numbers.

Submit each section separately.

- E. The submittals shall include the following:
 - Information that confirms compliance with contract requirements.
 - Include the manufacturer's name, model or catalog numbers, catalog information, technical data sheets, shop drawings, pictures, nameplate data and test reports as required.
 - Elementary and interconnection wiring diagrams for communication and signal systems, control system and equipment assemblies. All terminal points and wiring shall be identified on wiring diagrams.
 - Parts list which shall include those replacement parts recommended by the equipment manufacturer, quantity of parts, current price and availability of each part.
- F. Manuals: Submit in accordance with Section 01 00 00, GENERAL REQUIREMENTS.
 - 1. Maintenance and Operation Manuals: Submit as required for systems and equipment specified in the technical sections. Furnish four copies, bound in hardback binders, (manufacturer's standard binders) or an approved equivalent. Furnish one complete manual as specified in the technical section but in no case later than prior to performance of

systems or equipment test, and furnish the remaining manuals prior to contract completion.

Inscribe the following identification on the cover: the words

"MAINTENANCE AND OPERATION MANUAL," the name and location of the system, equipment, building, name of Contractor, and contract number. Include in the manual the names, addresses, and telephone numbers of each subcontractor installing the system or equipment and the local representatives for the system or equipment.

Provide a "Table of Contents" and assemble the manual to conform to the table of contents, with tab sheets placed before instructions covering the subject. The instructions shall be legible and easily read, with large sheets of drawings folded in.

The manuals shall include:

Internal and interconnecting wiring and control diagrams with data to explain detailed operation and control of the equipment.

A control sequence describing start-up, operation, and shutdown.

Description of the function of each principal item of equipment.

Installation and maintenance instructions.

Safety precautions.

Diagrams and illustrations.

Testing methods.

Performance data.

Pictorial "exploded" parts list with part numbers. Emphasis shall be placed on the use of special tools and instruments. The list shall indicate sources of supply, recommended spare parts, and name of servicing organization.

Appendix; list qualified permanent servicing organizations for support of the equipment, including addresses and certified qualifications.

Approvals will be based on complete submission of manuals together with shop drawings.

After approval and prior to installation, furnish the COTR with one sample of each of the following:

A 300 mm (12 inch) length of each type and size of wire and cable along with the tag from the coils of reels from which the samples were taken.

Each type of conduit and pathway coupling, bushing and termination fitting.

Raceway and pathway hangers, clamps and supports.

Duct sealing compound.

Label on cable samples for horizontal and backbone installations.
Faceplate label for horizontal cabling.

- I. In addition to the requirement of SUBMITTALS, the VA reserves the right to request the manufacturer to arrange for a VA representative to see typical active systems in operation, when there has been no prior experience with the manufacturer or the type of equipment being submitted.

1.11 SINGULAR NUMBER

Where any device or part of equipment is referred to in these specifications in the singular number (e.g., "the switch"), this reference shall be deemed to apply to as many such devices as are required to complete the installation as shown on the drawings.

1.12 TRAINING

Training shall be provided in accordance with Article, INSTRUCTIONS, of Section 01 00 00, GENERAL REQUIREMENTS.

Training shall be provided for the particular equipment or system as required in each associated specification.

A training schedule shall be developed and submitted by the contractor and approved by the Resident Engineer at least 30 days prior to the planned training.

- - - E N D - - -

SECTION 27 05 26
GROUNDING AND BONDING FOR COMMUNICATIONS SYSTEMS

PART 1 - GENERAL

1.1 DESCRIPTION

This section specifies general grounding and bonding requirements of telecommunication installations for equipment operations.

"Grounding electrode system" refers to all electrodes required by NEC, as well as including made, supplementary, telecommunications system grounding electrodes.

The terms "connect" and "bond" are used interchangeably in this specification and have the same meaning.

1.2 RELATED WORK

Section 26 05 26, GROUNDING AND BONDING FOR ELECTRICAL SYSTEM

Section 27 05 11, REQUIREMENTS FOR COMMUNICATIONS INSTALLATIONS:

General electrical requirements and items that are common to more than one section of Division 27.

Section 27 10 00, STRUCTURED CABLING: Low Voltage power and lighting wiring.

1.3 SUBMITTALS

- A. Submit in accordance with Section 27 05 11, REQUIREMENTS FOR COMMUNICATIONS INSTALLATIONS.
- B. Shop Drawings:

Sufficient information, clearly presented, shall be included to determine compliance with drawings and specifications.

Include the location of system grounding electrode connections and the routing of aboveground and underground grounding electrode conductors.
- C. Test Reports: Provide certified test reports of ground resistance.
- D. Certifications: Two weeks prior to final inspection, submit four copies of the following to the COTR:

Certification that the materials and installation is in accordance with the drawings and specifications.

Certification, by the Contractor, that the complete installation has been properly installed and tested.
- E. Samples: Provide sample of TMGB, bonding conductors and connection hardware for bonding conductor termination and mounting on busbars.

1.4 APPLICABLE PUBLICATIONS

Publications listed below (including amendments, addenda, revisions, supplements, and errata) form a part of this specification to the extent referenced. Publications are referenced in the text by the basic designation only.

American Society for Testing and Materials (ASTM):

- B1-2001 Standard Specification for Hard-Drawn Copper Wire
- B8-2004 Standard Specification for Concentric-Lay-Stranded Copper Conductors, Hard, Medium-Hard, or Soft

Institute of Electrical and Electronics Engineers, Inc. (IEEE):

- 81-1983 IEEE Guide for Measuring Earth Resistivity, Ground Impedance, and Earth Surface Potentials of a Ground System

National Fire Protection Association (NFPA):

- 70-2005 National Electrical Code (NEC)

Telecommunications Industry Association, (TIA)

- J-STO-607-A-2002 Commercial Building Grounding (Earthing) and Bonding Requirements for Telecommunications

Underwriters Laboratories, Inc. (UL):

- 44-2005 Thermoset-Insulated Wires and Cables
- 83-2003 Thermoplastic-Insulated Wires and Cables
- 467-2004 Grounding and Bonding Equipment
- 486A-486B-2003 Wire Connectors

PART 2 - PRODUCTS

2.1 GROUNDING AND BONDING CONDUCTORS

Equipment grounding conductors shall be UL 83 insulated stranded copper, for sizes #12 and larger. Insulation color shall be continuous green for all equipment grounding conductors, except that wire sizes 25 mm² (4 AWG) and larger shall be permitted to be identified per NEC.

Bonding conductors shall be ASTM B8 bare stranded copper, except that sizes 6 mm² (10 AWG) and smaller shall be ASTM B1 solid bare copper wire.

Isolated Power System: Type XHHW-2 insulation with a dielectric constant of 3.5 or less.

Telecom System Grounding Riser Conductor: Telecommunications Grounding Riser shall be in accordance with J STO-607A. Use a minimum 50mm² (1/0

AWG) insulated stranded copper grounding conductor unless indicated otherwise.

2.2 GROUND RODS

Copper clad steel, 19 mm (3/4-inch) diameter by 3000 mm (10 feet) long, conforming to UL 467.

Quantity of rods shall be as required to obtain the specified ground resistance.

2.3 SPLICES AND TERMINATION COMPONENTS

Components shall meet or exceed UL 467 and be clearly marked with the manufacturer, catalog number, and permitted conductor size(s).

2.4 TELECOMMUNICATION SYSTEM GROUND BUSBARS

A. Provide solid copper busbar, pre-drilled from two-hole lug connections with a minimum thickness of 6 mm (1/4 inch) for wall and backboard mounting using standard insulators sized as follows:

Room Signal Grounding: 300 mm x 100 mm (12 inches x 4 inch).

Master Signal Ground: 600 mm x 100 mm (24 inches x 4 inch).

2.5 GROUND CONNECTIONS

Below Grade: Exothermic-welded type connectors.

Above Grade:

Bonding Jumpers: compression type connectors, using zinc-plated fasteners and external tooth lockwashers.

Ground Busbars: Two-hole compression type lugs using tin-plated copper or copper alloy bolts and nuts.

Rack and Cabinet Ground Bars: one-hole compression-type lugs using zinc-plated or copper alloy fasteners.

A. Cable Shields: Make ground connections to multipair communications cables with metallic shields using shield bonding connectors with screw stud connection.

2.6 EQUIPMENT RACK AND CABINET GROUND BARS

Provide solid copper ground bars designed for mounting on the framework of open or cabinet-enclosed equipment racks with minimum dimensions of 4 mm thick by 19 mm wide (3/8 inch x 3/4 inch).

2.7 GROUND TERMINAL BLOCKS

At any equipment mounting location (e.g. backboards and hinged cover enclosures) where rack-type ground bars cannot be mounted, provide screw lug-type terminal blocks.

2.8 SPLICE CASE GROUND ACCESSORIES

Splice case grounding and bonding accessories shall be supplied by the splice case manufacturer when available. Otherwise, use 16 mm² (6 AWG) insulated ground wire with shield bonding connectors.

PART 3 - EXECUTION

3.1 GENERAL

- A. Ground in accordance with the NEC, as shown on drawings, and as hereinafter specified.
- B. System Grounding:
 - Secondary service neutrals: Ground at the supply side of the secondary disconnecting means and at the related transformers.
 - Separately derived systems (transformers downstream from the service entrance): Ground the secondary neutral.
 - Isolation transformers and isolated power systems shall not be system grounded.
- C. Equipment Grounding: Metallic structures (including ductwork and building steel), enclosures, raceways, junction boxes, outlet boxes, cabinets, machine frames, and other conductive items in close proximity with electrical circuits shall be bonded and grounded with green insulated conductor per 2.1.A.

3.2 INACCESSIBLE GROUNDING CONNECTIONS

Make grounding connections, which are buried or otherwise normally inaccessible (except connections for which periodic testing access is required) by exothermic weld.

3.3 SECONDARY EQUIPMENT AND CIRCUITS

Main Bonding Jumper: Bond the secondary service neutral to the ground bus in the service equipment.

Metallic Piping, Building Steel, and Supplemental Electrode(s):

Provide a grounding electrode conductor sized per NEC between the service equipment ground bus and all metallic water and gas pipe systems, building steel, and supplemental or made electrodes. Jumper insulating joints in the metallic piping. All connections to electrodes shall be made with fittings that conform to UL 467.

Provide a supplemental ground electrode and bond to the grounding electrode system.

Conduit Systems:

Ground all metallic conduit systems. All metallic conduit systems shall contain an equipment grounding conductor.

Non-metallic conduit systems shall contain an equipment grounding conductor.

Conduit containing only a grounding conductor, and which is provided for mechanical protection of the conductor, shall be bonded to that conductor at the entrance and exit from the conduit.

3.4 CORROSION INHIBITORS

When making ground and ground bonding connections, apply a corrosion inhibitor to all contact surfaces. Use corrosion inhibitor appropriate for protecting a connection between the metals used.

3.5 CONDUCTIVE PIPING

Bond all conductive piping systems, interior and exterior, to the building to the grounding electrode system. Bonding connections shall be made as close as practical to the equipment ground bus.

In operating rooms and at intensive care and coronary care type beds, bond the gases and suction piping, at the outlets, directly to the room or patient ground bus. 3.6

TELECOMMUNICATIONS SYSTEM

Bond telecommunications system grounding equipment to the electrical grounding electrode system.

Furnish and install all wire and hardware required to properly ground, bond and connect communications raceway, cable tray, metallic cable shields, and equipment to a ground source.

Ground bonding jumpers shall be continuous with no splices. Use the shortest length of bonding jumper possible.

Provide ground paths that are permanent and continuous with a resistance of 1 ohm or less from raceway, cable tray, and equipment connections to the building grounding electrode. The resistance across individual bonding connections shall be 10 milli ohms or less.

Below-Grade Grounding Connections: When making exothermic welds, wire brush or file the point of contact to a bare metal surface. Use exothermic welding cartridges and molds in accordance with the manufacturer's recommendations. After welds have been made and cooled, brush slag from the weld area and thoroughly cleaned the joint area. Notify the COTR prior to backfilling any ground connections.

F. Above-Grade Grounding Connections: When making bolted or screwed connections to attach bonding jumpers, remove paint to expose the entire contact surface by grinding where necessary; thoroughly clean all connector, plate and other contact surfaces; and apply an appropriate corrosion inhibitor to all surfaces before joining.

G. Bonding Jumpers:

Use insulated ground wire of the size and type shown on the Drawings or use a minimum of 16 mm² (6 AWG) insulated copper wire.

Assemble bonding jumpers using insulated ground wire terminated with compression connectors.

Use compression connectors of proper size for conductors specified. Use connector manufacturer's compression tool.

H. Bonding Jumper Fasteners:

Conduit: Fasten bonding jumpers using screw lugs on grounding bushings or conduit strut clamps, or the clamp pads on push-type conduit fasteners. When screw lug connection to a conduit strut clamp is not possible, fasten the plain end of a bonding jumper wire by slipping the plain end under the conduit strut clamp pad; tighten the clamp screw firmly. Where appropriate, use zinc-plated external tooth lockwashers.

Wireway and Cable Tray: Fasten bonding jumpers using zinc-plated bolts, external tooth lockwashers, and nuts. Install protective cover, e.g., zinc-plated acorn nuts on any bolts extending into wireway or cable tray to prevent cable damage.

Ground Plates and Busbars: Fasten bonding jumpers using two-hole compression lugs. Use tin-plated copper or copper alloy bolts, external tooth lockwashers, and nuts.

Unistrut and Raised Floor Stringers: Fasten bonding jumpers using zinc-plated, self-drill screws and external tooth lockwashers. 3.7

COMMUNICATION ROOM GROUNDING

A. Telecommunications Ground Busbars:

Provide communications room telecommunications ground busbar hardware at locations indicated on the Drawings.

Connect the telecommunications room ground busbars to other room grounding busbars as indicated on the Grounding Riser diagram.

- B. Ladder Style Cable Rack Systems: UL Classified side stringer serves as the primary ground conductor within the communications room. Make ground connections by installing the following bonding jumpers:
Install a 16 mm² (6 AWG) bonding between the telecommunications ground busbar and the nearest access to the cable rack.
Use 16 mm² (6 AWG) bonding jumpers or UL classified hardware to bond tray section.
- C. Self-Supporting and Cabinet-Mounted Equipment Rack Ground Bars:
When ground bars are provided at the rear of lineup of bolted together equipment racks, bond the copper ground bars together using solid copper splice plates supplied by the ground bar manufacturer.
Bond together nonadjacent ground bars on equipment racks and cabinets with 16 mm² (6 AWG) insulated copper wire bonding jumpers attached at each end with compression-type connectors and mounting bolts.
Provide a 16 mm² (6 AWG) bonding jumper between the rack and/or cabinet ground busbar and the overhead cable tray or the raised floor stringer as appropriate.
- E. Other Communication Room Ground Systems: Ground all metallic conduit, wireways, and other metallic equipment located away from equipment racks or cabinets to the cable tray or the telecommunications ground busbar, whichever is closer, using insulated 16 mm² (6 AWG) ground wire bonding jumpers.

3.8 COMMUNICATIONS CABLE GROUNDING

- A. Bond all metallic cable sheaths in multipair communications cables together at each splicing and/or terminating location to provide 100 percent metallic sheath continuity throughout the communications distribution system.
At terminal points, install a cable shield bonding connector provide a screw stud connection for ground wire. Use a bonding jumper to connect the cable shield connector to an appropriate ground source like the rack or cabinet ground bar.
Bond all metallic cable shields together within splice closures using cable shield bonding connectors or the splice case grounding and bonding accessories provided by the splice case manufacturer. When an external ground connection is provided as part of splice closure, connect to an approved ground source and all other metallic components and equipment at that location.

3.9 COMMUNICATIONS CABLE TRAY SYSTEMS:

- A. Bond the metallic structures of one cable tray in each tray run following the same path to provide 100 percent electrical continuity throughout this cable tray systems as follows:

Splice plates provided by the cable tray manufacturer can be used for providing a ground bonding connection between cable tray sections when the resistance across a bolted connection is 10 milliohms or less. The Subcontractor shall verify this loss by testing across one splice plate connection in the presence of the Contractor.

Install a 16 mm² (6 AWG) bonding jumper across each cable tray splice or junction where splice plates cannot be used.

When cable tray terminations to cable rack, install 16 mm² (6 AWG) bonding jumper between cable tray and cable rank side stringer.

3.10 COMMUNICATIONS RACEWAY GROUNDING

Conduit: Use insulated 16 mm² (6 AWG) bonding jumpers to ground metallic conduit at each end and to bond at all intermediate metallic enclosures.

Wireway: use insulated 16 mm² (6 AWG) bonding jumpers to ground or bond metallic wireway at each end at all intermediate metallic enclosures and across all section junctions.

Cable Tray Systems: Use insulated 16 mm² (6 AWG) bonding jumpers to ground cable tray to column-mounted building ground plates (pads) at each end and approximately every 16 meters (50 feet).

3.11 GROUND RESISTANCE

Grounding system resistance to ground shall not exceed 5 ohms. Make necessary modifications or additions to the grounding electrode system for compliance without additional cost to the Government. Final tests shall assure that this requirement is met.

Resistance of the grounding electrode system shall be measured using a four-terminal fall-of-potential method as defined in IEEE 81. Ground resistance measurements shall be made before the electrical distribution system is energized and shall be made in normally dry conditions not less than 48 hours after the last rainfall. Resistance measurements of separate grounding electrode systems shall be made before the systems are bonded together below grade. The combined resistance of separate systems may be used to meet the required

10-06M

resistance, but the

specified number of
27 05 26 - 9

electrodes must still be provided.

Services at power company interface points shall comply with the power company ground resistance requirements.

Below-grade connections shall be visually inspected by the COTR prior to backfilling. The Contractor shall notify the Resident Engineer 24 hours before the connections are ready for inspection.

3.12 GROUND ROD INSTALLATION

Drive each rod vertically in the earth, not less than 3000 mm (10 feet) in depth.

Where permanently concealed ground connections are required, make the connections by the exothermic process to form solid metal joints.

Make accessible ground connections with mechanical pressure type ground connectors.

Where rock prevents the driving of vertical ground rods, install angled ground rods or grounding electrodes in horizontal trenches to achieve the specified resistance.

- - - E N D - - -

THIS PAGE INTENTIONALLY LEFT BLANK

SECTION 27 05 33
RACEWAYS AND BOXES FOR COMMUNICATIONS SYSTEMS

PART 1 - GENERAL

1.1 DESCRIPTION

This section specifies the furnishing, installation, and connection of conduit, fittings, and boxes to form complete, coordinated, raceway systems. Raceways are required for all communications cabling unless shown or specified otherwise.

Definitions: The term conduit, as used in this specification, shall mean any or all of the raceway types specified.

1.2 RELATED WORK

Bedding of conduits: Section 31 20 00, EARTH MOVING.

Mounting board for communication closets: Section 06 10 00, ROUGH CARPENTRY.

Sealing around penetrations to maintain the integrity of fire rated construction: Section 07 84 00, FIRESTOPPING.

Fabrications for the deflection of water away from the building envelope at penetrations: Section 07 60 00, FLASHING AND SHEET METAL.

Sealing around conduit penetrations through the building envelope to prevent moisture migration into the building: Section 07 92 00, JOINT SEALANTS.

Identification and painting of conduit and other devices: Section 09 91 00, PAINTING.

General electrical requirements and items that is common to more than one section of Division 27: Section 27 05 11, REQUIREMENTS FOR COMMUNICATIONS INSTALLATIONS.

Requirements for personnel safety and to provide a low impedance path for possible ground fault currents: Section 27 05 26, GROUNDING AND BONDING FOR COMMUNICATIONS SYSTEMS.

1.3 SUBMITTALS

In accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, and SAMPLES, furnish the following:

A. Shop Drawings:

Size and location of panels and pull boxes

Layout of required conduit penetrations through structural elements.

The specific item proposed and its area of application shall be identified on the catalog cuts.

Certification: Prior to final inspection, deliver to the COTR four copies of the certification that the material is in accordance with the drawings and specifications and has been properly installed.

Samples of components.

1.4 APPLICABLE PUBLICATIONS

Publications listed below (including amendments, addenda, revisions, supplements and errata) form a part of this specification to the extent referenced. Publications are referenced in the text by the basic designation only.

National Fire Protection Association (NFPA):

70-05 National Electrical Code (NEC)

Underwriters Laboratories, Inc. (UL):

1-03 Flexible Metal Conduit

5-01 Surface Metal Raceway and Fittings

6-03 Rigid Metal Conduit

50-03 Enclosures for Electrical Equipment

360-03 Liquid-Tight Flexible Steel Conduit

467-01 Grounding and Bonding Equipment

514A-01 Metallic Outlet Boxes

514B-02 Fittings for Cable and Conduit

514C-05 Nonmetallic Outlet Boxes, Flush-Device Boxes and
Covers

651-02 Schedule 40 and 80 Rigid PVC Conduit

651A-03 Type EB and A Rigid PVC Conduit and HDPE Conduit

797-03 Electrical Metallic Tubing

1242-00 Intermediate Metal Conduit

National Electrical Manufacturers Association (NEMA):

TC-3-04 PVC Fittings for Use with Rigid PVC Conduit and
Tubing

FB1-03 Fittings, Cast Metal Boxes and Conduit Bodies
for Conduit, Electrical Metallic Tubing and
Cable

PART 2 - PRODUCTS

2.1 MATERIAL

Conduit Size: In accordance with the NEC, but not less than 26 mm (1 inch) unless otherwise shown.

Conduit:

Rigid galvanized steel: Shall Conform to UL 6, ANSI C80.1.

Aluminum conduit is not allowed.

Rigid intermediate steel conduit (IMC): Shall Conform to UL 1242, ANSI C80.6.

Electrical metallic tubing (EMT): Shall Conform to UL 797, ANSI C80.3. Maximum size not to exceed 105 mm (4 inch) and shall be permitted only with cable rated 600 volts or less.

Flexible galvanized steel conduit: Shall Conform to UL 1.

Liquid-tight flexible metal conduit: Shall Conform to UL 360.

Direct burial plastic conduit: Shall conform to UL 651 and UL 651A, heavy wall PVC or high density polyethylene (PE).

Surface metal raceway: Shall Conform to UL 5.

C. Conduit Fittings:

1. Rigid steel and IMC conduit fittings:

- a. Fittings shall meet the requirements of UL 514B and ANSI/NEMA FB1.

Standard threaded couplings, locknuts, bushings, and elbows: Only steel or malleable iron materials are acceptable. Integral retractable type IMC couplings are also acceptable.

Locknuts: Bonding type with sharp edges for digging into the metal wall of an enclosure.

Bushings: Metallic insulating type, consisting of an insulating insert molded or locked into the metallic body of the fitting. Bushings made entirely of metal or nonmetallic material are not permitted.

Sealing fittings: Threaded cast iron type. Use continuous drain type sealing fittings to prevent passage of water vapor. In concealed work, install fittings in flush steel boxes with blank cover plates having the same finishes as that of other electrical plates in the room.

2. Electrical metallic tubing fittings:

Fittings shall meet the requirements of UL 514B and ANSI/NEMA FB1.

Only steel or malleable iron materials are acceptable.

Couplings and connectors: Concrete tight and rain tight, with connectors having insulated throats. Use gland and ring compression type couplings and connectors for conduit sizes 50 mm (2 inches) and smaller. Use set screw type couplings with four set screws each for conduit sizes over 50 mm (2 inches). Use set screws of case-hardened steel with hex head and cup point to firmly seat in wall of conduit for positive grounding.

Indent type connectors or couplings are prohibited.

Die-cast or pressure-cast zinc-alloy fittings or fittings made of "pot metal" are prohibited.

3. Flexible steel conduit fittings:

Conform to UL 514B. Only steel or malleable iron materials are acceptable.

Clamp type, with insulated throat.

4. Liquid-tight flexible metal conduit fittings:

Fittings shall meet the requirements of UL 514B and ANSI/ NEMA FB1.

Only steel or malleable iron materials are acceptable.

Fittings must incorporate a threaded grounding cone, a steel or plastic compression ring, and a gland for tightening. Connectors shall have insulated throats.

5. Direct burial plastic conduit fittings:

Fittings shall meet the requirements of UL 514C and NEMA TC3.

As recommended by the conduit manufacturer.

6. Surface metal raceway fittings: As recommended by the raceway manufacturer.

7. Expansion and deflection couplings:

Conform to UL 467 and UL 514B.

Accommodate, 19 mm (0.75 inch) deflection, expansion, or contraction in any direction, and allow 30 degree angular deflections.

Include internal flexible metal braid sized to guarantee conduit ground continuity and fault currents in accordance with UL 467, and the NEC code tables for ground conductors.

Jacket: Flexible, corrosion-resistant, watertight, moisture and heat resistant molded rubber material with stainless steel jacket clamps.

D. Conduit Supports:

Parts and hardware: Zinc-coat or provide equivalent corrosion protection.

Individual Conduit Hangers: Designed for the purpose, having a pre-assembled closure bolt and nut, and provisions for receiving a hanger rod.

Multiple conduit (trapeze) hangers: Not less than 38 mm by 38 mm (1-1/2 by 1-1/2 inch), 12 gage steel, cold formed, lipped channels; with not less than 9 mm (3/8 inch) diameter steel hanger rods.

Solid Masonry and Concrete Anchors: Self-drilling expansion shields, or machine bolt expansion.

E. Outlet, Junction, and Pull Boxes:

UL-50 and UL-514A.

Cast metal where required by the NEC or shown, and equipped with rustproof boxes.

Sheet metal boxes: Galvanized steel, except where otherwise shown.

Flush mounted wall or ceiling boxes shall be installed with raised covers so that front face of raised cover is flush with the wall.

Surface mounted wall or ceiling boxes shall be installed with surface style flat or raised covers.

F. Wireways: Equip with hinged covers, except where removable covers are shown.**G. Warning Tape: Standard, 4-Mil polyethylene 76 mm (3 inch) wide tape, detectable type, red with black letters, and imprinted with "CAUTION BURIED COMMUNICATIONS CABLE BELOW".****PART 3 - EXECUTION****3.1 PENETRATIONS****A. Cutting or Holes:**

Locate holes in advance where they are proposed in the structural sections such as ribs or beams. Obtain the approval of the COTR prior to drilling through structural sections.

Cut holes through concrete and masonry in new and existing structures with a diamond core drill or concrete saw. Pneumatic hammer, impact electric, hand or manual hammer type drills are not allowed, except where permitted by the COTR as required by limited working space.

B. Fire Stop: Where conduits, wireways, and other communications raceways pass through fire partitions, fire walls, smoke partitions, or floors, install a fire stop that provides an effective barrier against the spread of fire, smoke and gases as specified in Section 07 84 00,

FIRESTOPPING, with rock wool fiber or silicone foam sealant only. Completely fill and seal clearances between raceways and openings with the fire stop material.

- C. Waterproofing: At floor, exterior wall, and roof conduit penetrations, completely seal clearances around the conduit and make watertight as specified in Section 07 92 00, JOINT SEALANTS.

3.2 INSTALLATION, GENERAL

- A. Install conduit as follows:

In complete runs before pulling in cables or wires.

Flattened, dented, or deformed conduit is not permitted. Remove and replace the damaged conduits with new undamaged material.

Assure conduit installation does not encroach into the ceiling height head room, walkways, or doorways.

Cut square with a hacksaw, ream, remove burrs, and draw up tight.

Mechanically continuous.

Independently support conduit at 8'0" on center. Do not use other supports i.e., (suspended ceilings, suspended ceiling supporting members, lighting fixtures, conduits, mechanical piping, or mechanical ducts).

Support within 300 mm (1 foot) of changes of direction, and within 300 mm (1 foot) of each enclosure to which connected.

Close ends of empty conduit with plugs or caps at the rough-in stage to prevent entry of debris, until wires are pulled in.

Conduit installations under fume and vent hoods are prohibited.

Secure conduits to cabinets, junction boxes, pull boxes and outlet boxes with bonding type locknuts. For rigid and IMC conduit installations, provide a locknut on the inside of the enclosure, made up wrench tight. Do not make conduit connections to junction box covers.

Flashing of penetrations of the roof membrane is specified in Section 07 60 00, FLASHING AND SHEET METAL.

Do not use aluminum conduits in wet locations.

Unless otherwise indicated on the drawings or specified herein, all conduits shall be installed concealed within finished walls, floors and ceilings.

- B. Conduit Bends:

Make bends with standard conduit bending machines.

Conduit hickey may be used for slight offsets, and for straightening stubbed out conduits.

3. Bending of conduits with a pipe tee or vise is prohibited.

Layout and Homeruns: 1. Deviations: Make only where necessary to avoid interferences and only after drawings showing the proposed deviations have been submitted approved by the COTR. **3.3 CONCEALED WORK INSTALLATION**

A. In Concrete:

1. Conduit: Rigid steel, IMC or EMT. Do not install EMT in concrete slabs that are in contact with soil, gravel or vapor barriers.
2. Align and run conduit in direct lines.
3. Install conduit through concrete beams only when the following occurs:

Where shown on the structural drawings.

As approved by the COTR prior to construction, and after submittal of drawing showing location, size, and position of each penetration.

4. Installation of conduit in concrete that is less than 75 mm (3 inches) thick is prohibited.

Conduit outside diameter larger than 1/3 of the slab thickness is prohibited.

Space between conduits in slabs: Approximately six conduit diameters apart, except one conduit diameter at conduit crossings.

Install conduits approximately in the center of the slab so that there will be a minimum of 19 mm (3/4 inch) of concrete around the conduits.

5. Make couplings and connections watertight. Use thread compounds that are UL approved conductive type to insure low resistance ground continuity through the conduits. Tightening set screws with pliers is prohibited.

B. Furred or Suspended Ceilings and in Walls:

Conduit for conductors 600 volts and below:

- a. Rigid steel, IMC, rigid aluminum, or EMT. Different type conduits mixed indiscriminately in the same system is prohibited.

Align and run conduit parallel or perpendicular to the building lines.

Tightening set screws with pliers is prohibited.

3.4 EXPOSED WORK INSTALLATION

Unless otherwise indicated on the drawings, exposed conduit is only permitted in mechanical and electrical rooms.

Conduit for Conductors 600 volts and below:

1. Rigid steel, IMC, rigid aluminum, or EMT. Different type of conduits mixed indiscriminately in the system is prohibited.

Align and run conduit parallel or perpendicular to the building lines. Install horizontal runs close to the ceiling or beams and secure with conduit straps.

Support horizontal or vertical runs at not over 2400 mm (eight foot) intervals.

Surface metal raceways: Use only where shown.

Painting:

Paint exposed conduit as specified in Section 09 91 00, PAINTING.

Paint all conduits containing cables rated over 600 volts safety orange. Refer to Section 09 91 00, PAINTING for preparation, paint type, and exact color. In addition, paint legends, using 50 mm (two inch) high black numerals and letters, showing the cable voltage rating. Provide legends where conduits pass through walls and floors and at maximum 6000 mm (20 foot) intervals in between.

3.5 EXPANSION JOINTS

Conduits 75 mm (3 inches) and larger, that are secured to the building structure on opposite sides of a building expansion joint, require expansion and deflection couplings. Install the couplings in accordance with the manufacturer's recommendations.

Provide conduits smaller than 75 mm (3 inches) with junction boxes on both sides of the expansion joint. Connect conduits to junction boxes with sufficient slack of flexible conduit to produce 125 mm (5 inch) vertical drop midway between the ends. Flexible conduit shall have a copper green ground bonding jumper installed. In lieu of this flexible conduit, expansion and deflection couplings as specified above for 375 mm (15 inches) and larger conduits are acceptable.

Install expansion and deflection couplings where shown.

3.6 CONDUIT SUPPORTS, INSTALLATION

Safe working load shall not exceed 1/4 of proof test load of fastening devices.

Use pipe straps or individual conduit hangers for supporting individual conduits. Maximum distance between supports is 2.5 m (8 foot) on center.

Support multiple conduit runs with trapeze hangers. Use trapeze hangers that are designed to support a load equal to or greater than the sum of the weights of the conduits, wires, hanger itself, and 90 kg (200 pounds). Attach each conduit with U-bolts or other approved fasteners.

- D. Support conduit independently of junction boxes, pull boxes, fixtures, suspended ceiling T-bars, angle supports, and similar items.
- E. Fasteners and Supports in Solid Masonry and Concrete:
 - New Construction: Use steel or malleable iron concrete inserts set in place prior to placing the concrete.
 - Existing Construction:
 - Steel expansion anchors not less than 6 mm (1/4 inch) bolt size and not less than 28 mm (1-1/8 inch) embedment.
 - Power set fasteners not less than 6 mm (1/4 inch) diameter with depth of penetration not less than 75 mm (3 inches).
 - Use vibration and shock resistant anchors and fasteners for attaching to concrete ceilings.
- F. Hollow Masonry: Toggle bolts are permitted.
- G. Bolts supported only by plaster or gypsum wallboard are not acceptable.
- H. Metal Structures: Use machine screw fasteners or other devices specifically designed and approved for the application.
- I. Attachment by wood plugs, rawl plug, plastic, lead or soft metal anchors, or wood blocking and bolts supported only by plaster is prohibited.
- J. Chain, wire, or perforated strap shall not be used to support or fasten conduit.
- K. Spring steel type supports or fasteners are prohibited for all uses except: Horizontal and vertical supports/fasteners within walls.
- L. Vertical Supports: Vertical conduit runs shall have riser clamps and supports in accordance with the NEC and as shown. Provide supports for cable and wire with fittings that include internal wedges and retaining collars.

3.7 BOX INSTALLATION

- A. Boxes for Concealed Conduits:
 - Flush mounted.
 - Provide raised covers for boxes to suit the wall or ceiling, construction and finish.
- B. In addition to boxes shown, install additional boxes where needed to prevent damage to cables and wires during pulling in operations.
- C. Remove only knockouts as required and plug unused openings. Use threaded plugs for cast metal boxes and snap-in metal covers for sheet metal boxes.
- D. Label all covers of electrical boxes with the patch panel name and ports contained in the box; for example: A1, A2, A3, etc.

- E. For boxes installed in metal stud construction, use rigid support metal bar hangers or metal bar fasteners attached to two studs. Screwing boxes directly to joists or studs is not acceptable.

3.8 COMMUNICATION SYSTEM CONDUIT

- A. Install the communication raceway system as shown on drawings.
- B. Minimum conduit size of 26 mm (1 inch), but not less than the size shown on the drawings.
- C. All conduit ends shall be equipped with insulated bushings.
- D. All 100 mm (four inch) conduits within buildings shall include pull boxes after every two 90 degree bends. Size boxes per the NEC.
- E. Vertical conduits/sleeves through closets floors shall terminate not less than 75 mm (3 inches) below the floor and not less than 75 mm (3 inches) below the ceiling of the floor below.
- F. Terminate conduit runs to/from a backboard in a closet or interstitial space at the top or bottom of the backboard. Conduits shall enter communication closets next to the wall and be flush with the backboard.
- G. Where drilling is necessary for vertical conduits, locate holes so as not to affect structural sections such as ribs or beams.
- H. All empty conduits located in communication closets or on backboards shall be sealed with a standard non-hardening duct seal compound to prevent the entrance of moisture and gases and to meet fire resistance requirements.
- I. Conduit runs shall contain no more than two quarter turns (90 degree bends) between pull boxes/backboards. Minimum radius of communication conduit bends shall be as follows (special long radius):

Sizes of Conduit Trade Size	Radius of Conduit Bends mm, Inches
1	230 (9)
1-1/4	350 (14)
1-1/2	430 (17)
2	525 (21)
2-1/2	635 (25)
3	775 (31)
3-1/2	900 (36)
4	1125 (45)

- J. Furnish and install 19 mm (3/4 inch) thick fire retardant plywood specified in Section 06 10 00, ROUGH CARPENTRY on the wall of

communication closets where shown on drawings . Mount the plywood with the bottom edge 300 mm (one foot) above the finished floor.

K. Furnish and pull wire in all empty conduits. (Sleeves through floor are exceptions).

- - - E N D - - -

**SECTION 27 10 00
STRUCTURED CABLING**

PART 1 - GENERAL

1.1 DESCRIPTION

A. This section specifies the furnishing, installation, and connection of the structured cabling system to provide a comprehensive telecommunications infrastructure.

1.2 RELATED WORK

Excavation and backfill for cables that are installed in conduit:

Section 31 20 00, EARTH MOVING.

Sealing around penetrations to maintain the integrity of time rated construction: Section 07 84 00, FIRESTOPPING.

General electrical requirements that are common to more than one section in Division 27: Section 27 05 11, REQUIREMENTS FOR COMMUNICATIONS INSTALLATIONS.

Conduits for cables and wiring: Section 27 05 33, RACEWAYS AND BOXES FOR COMMUNICATIONS SYSTEMS.

Requirements for personnel safety and to provide a low impedance path for possible ground fault currents: Section 27 05 26, GROUNDING AND BONDING FOR COMMUNICATIONS SYSTEMS.

1.3 SUBMITTALS

A. In accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES, furnish the following:

Manufacturer's Literature and Data: Showing each cable type and rating.

Certificates: Two weeks prior to final inspection, deliver to the COTR four copies of the certification that the material is in accordance with the drawings and specifications and has been properly installed.

1.4 APPLICABLE PUBLICATIONS

Publications listed below (including amendments, addenda, revisions, supplements and errata) form a part of this specification to the extent referenced. Publications are reference in the text by the basic designation only.

American Society of Testing Material (ASTM):

D2301-04 Standard Specification for Vinyl Chloride
Plastic Pressure Sensitive Electrical Insulating
Tape

Federal Specifications (Fed. Spec.):

A-A-59544-00 Cable and Wire, Electrical (Power, Fixed Installation)

National Fire Protection Association (NFPA):

70-05 National Electrical Code (NEC)

Underwriters Laboratories, Inc. (UL):

44-02Thermoset-Insulated Wires and Cables

83-03Thermoplastic-Insulated Wires and Cables

467-01Electrical Grounding and Bonding Equipment

486A-01Wire Connectors and Soldering Lugs for Use with Copper Conductors

486C-02Splicing Wire Connectors

486D-02 Insulated Wire Connector Systems for Underground Use or in Damp or Wet Locations

486E-00 Equipment Wiring Terminals for Use with Aluminum and/or Copper Conductors

493-01 Thermoplastic-Insulated Underground Feeder and Branch Circuit Cable

514B-02Fittings for Cable and Conduit

1479-03Fire Tests of Through-Penetration Fire Stops

American National Standards Institute (ANSI)/ Telecommunications

Industries Association (TIA)

758-B Customer-Owned Outside Plant Telecommunications Cabling Standard

PART 2 - PRODUCTS

2.1 CONTROL WIRING

Unless otherwise specified in other sections of these specifications, control wiring shall be as specified for power and lighting wiring, except the minimum size shall be not less than No. 14 AWG.

Control wiring shall be large enough so that the voltage drop under inrush conditions does not adversely affect operation of the controls. **2.2 COMMUNICATION AND SIGNAL WIRING**

Shall conform to the recommendations of the manufacturers of the communication and signal systems; however, not less than what is shown. Wiring shown is for typical systems. Provide wiring as required for the systems being furnished.

Multi-conductor cables shall have the conductors insulation color coded.

2.3 WIRE LUBRICATING COMPOUND

Suitable for the wire insulation and conduit it is used with, and shall not harden or become adhesive.

Shall not be used on wire for isolated type electrical power systems.

2.4 FIREPROOFING TAPE

The tape shall consist of a flexible, conformable fabric of organic composition coated one side with flame-retardant elastomer.

The tape shall be self-extinguishing and shall not support combustion.

It shall be arc-proof and fireproof.

The tape shall not deteriorate when subjected to water, gases, salt water, sewage, or fungus and be resistant to sunlight and ultraviolet light.

The finished application shall withstand a 200-ampere arc for not less than 30 seconds.

Securing tape: Glass cloth electrical tape not less than 0.18 mm (7 mils) thick, and 19 mm (3/4 inch) wide.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

Install all wiring in raceway systems.

Seal cable and wire entering a building from underground, between the wire and conduit where the cable exits the conduit, with a non-hardening approved compound.

Wire Pulling:

Provide installation equipment that will prevent the cutting or abrasion of insulation during pulling of cables.

Use ropes made of nonmetallic material for pulling feeders.

Attach pulling lines for feeders by means of either woven basket grips or pulling eyes attached directly to the conductors, as approved by the COTR.

Pull in multiple cables together in a single conduit or inner duct.

3.2 INSTALLATION IN MANHOLES

A. Install and support cables in manholes on the support hardware. Train the cables around the manhole walls, but do not bend to a radius less than ten times the overall cable diameter.

3.3 CONTROL, COMMUNICATION AND SIGNAL WIRING INSTALLATION

A. Unless otherwise specified in other sections, install wiring and connect to equipment/devices to perform the required functions as shown and specified.

Except where otherwise required, install a separate power supply circuit for each system so that malfunctions in any system will not affect other systems.

Where separate power supply circuits are not shown, connect the systems to the nearest panelboards of suitable voltages, which are intended to supply such systems and have suitable spare circuit breakers or space for installation.

Install a red warning indicator on the handle of the branch circuit breaker for the power supply circuit for each system to prevent accidental de-energizing of the systems.

System voltages shall be 120 volts or lower where shown on the drawings or as required by the NEC.

3.4 CONTROL, COMMUNICATION AND SIGNAL SYSTEM IDENTIFICATION

Install a permanent wire marker on each wire at each termination.

Identifying numbers and letters on the wire markers shall correspond to those on the wiring diagrams used for installing the systems.

Wire markers shall retain their markings after cleaning.

In each manhole and handhole, install embossed brass tags to identify the system served and function.

3.5 EXISTING WIRING

Unless specifically indicated on the plans, existing wiring shall not be reused for the new installation. Only wiring that conforms to the specifications and applicable codes may be reused. If existing wiring does not meet these requirements, existing wiring may not be reused and new wires shall be installed.

- - - E N D - - -

SECTION 27 11 00
COMMUNICATIONS EQUIPMENT ROOM FITTINGS

PART 1 - GENERAL

1.1 DESCRIPTION

This Section specifies the furnishing, installing, certification, testing, and guaranty of a complete and operating Voice and Digital Cable Distribution System (here-in-after referred to as "*the System*"), and associated equipment and hardware to be installed in the VA CLC Buildings here-in-after referred to as "*the Facility*". The System shall include, but not be limited to: equipment cabinets, interface enclosures, and relay racks; necessary combiners, traps, and filters; and necessary passive devices such as: splitters, couplers, cable "patch", "punch down", and cross-connector blocks or devices, voice and data distribution sub-systems, and associated hardware. The System shall additionally include, but not be limited to: telecommunication closets (TC); telecommunications outlets (TCO); copper and fiber optic, and analog radio frequency (RF) systems coaxial distribution cables, connectors, "patch" cables, and/or "break out" devices.

The System shall be delivered free of engineering, manufacturing, installation, and functional defects. It shall be designed, engineered and installed for ease of operation, maintenance, and testing.

The term "provide", as used herein, shall be defined as: designed, engineered, furnished, installed, certified, and tested, by the Contractor.

The Voice and Digital and Analog Telecommunication Distribution Cable Equipment and System provides the media which voice and data information travels over and connects to the Telephone System which is defined as an Emergency Critical Care Communication System by the National Fire Protection Association (NFPA). Therefore, since the System connects to or extends the telephone system, the System's installation and operation shall adhere to all appropriate National, Government, and/or Local Life Safety and/or Support Codes, which ever are the more stringent for this Facility. At a minimum , the System shall be installed according to NFPA, Section 70, National Electrical Code (NEC), Article 517 and Chapter 7; NFPA, Section 99, Health Care Facilities, Chapter 3-4; NFPA, Section 101, Life Safety Code, Chapters 7, 12, and/or 13; Joint Commission on Accreditation of Health Care Organization (JCAHCO), Manual for Health Care Facilities, all necessary

Life Safety and/or Support guidelines; this specification; and the original equipment manufacturer's (OEM) suggested installation design, recommendations, and instructions. The OEM and Contractor shall ensure that all management, sales, engineering, and installation personnel have read and understand the requirements of this specification before the System is designed, engineered, delivered, and provided.

The COTR are the approving authorities for all contractual and mechanical changes to the System. The Contractor is cautioned to obtain in writing, all approvals for system changes relating to the published contract specifications and drawings, from the COTR before proceeding with the change.

System Performance:

1. At a minimum, the System shall be able to support the following voice and data and analog RF operations for Category 6 Certified Telecommunication Service:
 - a. Provide the following interchange (or interface) capabilities:
 - Basic Rate (BRI).
 - Primary Rate (PRI).
 - b. ISDN
 - 1) Narrow Band BRI:
 - B Channel: 64 kilo-Bits per second (kBps), minimum.
 - D Channel: 16 kBps, minimum.
 - H Channel: 384 kBps, minimum.
 - 2) Narrow Band PRI:
 - B Channel: 64 kBps, minimum.
 - D Channel: 64 kBps, minimum.
 - H Channel: 1,920 kBps, minimum.
 - 3) Wide (or Broad) Band: All channels: 140 mega(m)-Bps, minimum, capable to 565 mBps at "T" reference.
 - c. ATM operation and interface: ATM 155 Mb/s.
 - d. Frame Relay: All stated compliance's.
 - e. Integrated Data Communications Utility (IDCU) operation and interface.
 - f. Government Open Systems Interconnection Profile (GOSSIP) compliant.
 - g. Fiberoptic Distributed Data Interface (FDDI): A minimum 100 Mb/s to a maximum of 1.8 giga(g)-b/s data bit stream speed (shall be Synchronous Optical Network [SONET] compliant).

h. System Sensitivity: Satisfactory service shall be provided for at least 3,000 feet for all voice and data and analog RF locations. 2. At a minimum the System shall support the following operating parameters:

a. EPBX connection:

System speed: 1.0 Gb/s per second, minimum.

Impedance: 600 Ohms.

Cross Modulation: -60 deci-Bel (dB).

Hum Modulation: -55 dB.

System data error: 10 to the -10 b/s, minimum.

Loss: Measured at the frame output with reference Zero (0) deciBel measured (dBm) at 1,000 Hertz (Hz) applied to the frame input.

Trunk to station: 1.5 dB, maximum.

Station to station: 3.0 dB, maximum.

Internal switch crosstalk: -60 dB when a signal of + 10 deciBel measured (dBm), 500-2,500 Hz range is applied to the primary path.

Idle channel noise: 25 dBm "C" or 3.0 dBm "O" above reference (terminated) ground noise, whichever is greater.

Traffic Grade of Service for Voice and Data:

A minimum grade of service of P-01 with an average traffic load of 7.0 CCS per station per hour and a traffic overload in the data circuits will not interfere with, or degrade, the voice service.

Average CCS per voice station: The average CCS capacity per voice station shall be maintained at 7.0 CCS when the EPBX is expanded up to the projected maximum growth as stated herein.

b. Telecommunications Outlet (TCO):

1) Voice:

Isolation (outlet-outlet): 24 dB.

Impedance: 600 Ohms, balanced (BAL).

Signal Level: 0 deciBel per mili-Volt (dBmV) + 0.1 dBmV.

System speed: 1 Gb/s, minimum.

System data error: 10 to the -6 Bps, minimum.

2) Data:

a) Isolation (outlet-outlet): 24 dB.

Impedance: 600 Ohms, BAL.

Signal Level: 0 dBmV + 0.1 dBmV.

System speed: 1 Gb/s, minimum.

System data error: 10 to the -8 b/s, minimum.

3) Fiber optic:

Isolation (outlet-outlet): 36 dB.

Signal Level: 0 dBmV + 0.1 dBmV.

System speed: 1 Gb/s, minimum.

System data error: 10 to the -6 b/s, minimum.

4) Analog RF Service:

Broadcast or "off air" RF (or television) analog service is considered to be at RF (below 900 MHz in frequency bandwidth). Usually a RF television circuits require a single coaxial cable plant from the headend to each TC location.

Isolation (outlet-outlet): 14 dB.

Impedance: 75 Ohms, Unbalanced (UNBAL).

Signal Level: 10 dBmV + 5.0 dBmV.

Bandwidth: 6.0 MHz per channel, fully loaded.

5) Closed Circuit Video Service: Video service for security shall be provided over the same media as data with the same specifications. An analog video circuit requires a separate analog video from the audio connector. The following minimum operating parameters shall be capable over each installed analog video circuit:

1.2 RELATED WORK

Specification Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

Specification Section 27 05 11, REQUIREMENTS FOR COMMUNICATIONS INSTALLATIONS.

Specification Section 27 05 33, RACEWAYS AND BOXES FOR COMMUNICATIONS SYSTEMS.

Specification Section 27 10 00, STRUCTURED CABLING.

Specification Section 26 27 26, WIRING DEVICES.

Specification Section 27 05 26, GROUNDING AND BONDING FOR COMMUNICATIONS SYSTEMS.

Specification Section 27 41 31, MASTER ANTENNA TV EQUIPMENT AND SYSTEMS.

1.3 APPLICABLE PUBLICATIONS

The publications listed below form a part of this specification to the extent referenced. The publications are referenced in text by basic designation only. Except for a specific date given the issue in effect (including amendments, addenda, revisions, supplements, and errata) on the date the system's submittal is technically approved by VA, shall be enforced.

National Fire Protection Association (NFPA):

70	NATIONAL ELECTRICAL CODE (NEC)
75	Protection of Electronic Computer/Data Processing Equipment
77	Recommended Practice on Static Electricity
	Standard for Health Care Facilities
101	Life Safety Code
1221	Emergency Services Communication Systems

Underwriters Laboratories, Inc. (UL):

65	Wired Cabinets
96	Lightning Protection Components
96A	INSTALLATION REQUIREMENTS FOR LIGHTNING PROTECTION SYSTEMS
467	Grounding and Bonding Equipment
497/497A/497B	PROTECTORS FOR PAIRED CONDUCTORS/ COMMUNICATIONS CIRCUITS/DATA COMMUNICATIONS AND FIRE ALARM CIRCUITS
884	Underfloor Raceways and Fittings

ANSI/EIA/TIA Publications:

568C	Commercial Building Telecommunications Wiring Standard
569B	Commercial Building Standard for Telecommunications Pathways and Spaces
606A	ADMINISTRATION STANDARD FOR THE TELECOMMUNICATIONS INFRASTRUCTURE OF COMMERCIAL BUILDINGS
607A	Grounding and Bonding Requirements for Telecommunications in Commercial Buildings
758-B	Customer-Owned Outside Plant Telecommunication Cabling Standard.

Lucent Technologies: Document 900-200-318 "Outside Plant Engineering Handbook".

International Telecommunication Union - Telecommunication Standardization Sector (ITU-T).

Federal Information Processing Standards (FIPS) Publications.

Federal Communications Commission (FCC) Publications: Standards for telephone equipment and systems.

United States Air Force: Technical Order 33K-1-100 Test Measurement and Diagnostic Equipment (TMDE) Interval Reference Guide.

Joint Commission on Accreditation of Health Care Organization (JCAHO): Comprehensive Accreditation Manual for Hospitals.

National and/or Government Life Safety Code(s): The more stringent of each listed code. **1.4 QUALITY ASSURANCE**

The authorized representative of the OEM, shall be responsible for the design, satisfactory total operation of the System, and its certification.

The OEM shall meet the minimum requirements identified in Paragraph 2.1.A. Additionally, the Contractor shall have had experience with three or more installations of systems of comparable size and complexity with regards to coordinating, engineering, testing, certifying, supervising, training, and documentation. Identification of these installations shall be provided as a part of the submittal as identified in Paragraph 1.5.

The System Contractor shall submit certified documentation that they have been an authorized distributor and service organization for the OEM for a minimum of three (3) years. The System Contractor shall be authorized by the OEM to certify and warranty the installed equipment. In addition, the OEM and System Contractor shall accept complete responsibility for the design, installation, certification, operation, and physical support for the System. This documentation, along with the System Contractor and OEM certification must be provided in writing as part of the Contractor's Technical Submittal.

All equipment, cabling, terminating hardware, TCOs, and patch cords shall be sourced from the certifying OEM or at the OEM's direction, and support the System design, the OEM's quality control and validity of the OEM's warranty.

- E. The Contractor's Telecommunications Technicians assigned to the System shall be fully trained, qualified, and certified by the OEM on the engineering, installation, and testing of the System. The Contractor shall provide formal written evidence of current OEM certification(s) for the installer(s) as a part of the submittal or to the COTR before being allowed to commence work on the System.

1.5 SUBMITTALS

- A. Provide submittals in accordance with Specification Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, and SAMPLES. The COTR shall retain one copy for review and approval.

If the submittal is approved the COTR shall retain one copy for Official Records and return three (3) copies to the Contractor.

If the submittal is disapproved, three (3) copies will be returned to the Contractor with a written explanation attached that indicates the areas the submittal deviated from the System specifications. The COTR shall retain one copy for Official Records.

- B. Documents: The submittal shall be separated into sections for each subsystem and shall contain the following:

1. Title page to include:

VA Medical Center.

Contractor's name, address, and telephone (including FAX) numbers.

Date of Submittal.

VA Project No.

2. Narrative Description of the system.
3. A List of the equipment to be furnished. The quantity, make, and model number of each item is required. Select the required equipment items quantities that will satisfy the needs of the system. The following is the minimum equipment required by the system:

QUANTITY	UNIT
As required	Equipment Rack
As required	Cross Connection (CCS) Systems
As required	Wire Management System/Equipment
As required	Telecommunications Outlets (TCO)
As Required	Distribution Cables
As required	TCO Connection Cables
As required	System Connectors

As required	Terminators
As required	Distribution Frames
As required	Telecommunications Closets (TC)
As required	Environmental Requirements
1 ea.	Installation Kit
As-required	Separate List Containing Each Equipment Spare(s)

Pictorial layouts of each MTC, IMTC, and RTCs; MCCS, IMCCS, VCCS, and HCCS termination cabinet(s), each distribution cabinet layout drawing, and TCO as each is expected to be installed and configured. Equipment technical literature detailing the electrical and technical characteristics of each item of equipment to be furnished. Engineering drawings of the System showing each input and output distribution point, proposed TCO, and each TCO multipin, fiberoptic, and coaxial cable jack.

List of test equipment as per paragraph 1.5.D. below.

Letter certifying that the Contractor understands the requirements of the SAMPLES Paragraph 1.5.E.

Letter certifying that the Contractor understands the requirements of Section 3.2 concerning acceptance tests.

C. Test Equipment List:

The Contractor is responsible for furnishing all test equipment required to test the system in accordance with the parameters specified. Unless otherwise stated, the test equipment shall not be considered part of the system. The Contractor shall furnish test equipment of accuracy better than the parameters to be tested.

The test equipment furnished by the Contractor shall have a calibration tag of an acceptable calibration service dated not more than 12 months prior to the test. As part of the submittal, a test equipment list shall be furnished that includes the make and model number of the following type of equipment as a minimum:

Spectrum Analyzer.

Signal Level Meter.

Volt-Ohm Meter.

Optical Time Domain Reflectometer (OTDR).

Digital Camera. A video camera in VHS format is an acceptable alternate.

Copper Certification Tester.

Color Video Monitor with audio capability.

100 MHz Oscilloscope with video adapters.

D. Samples: A sample of each of the following items shall be furnished to the COTR for approval prior to installation.

1. TCO Wall Outlet Box 4" x 4"x 2.5" with:
 - One each telephone (or voice) RJ45 jack installed.
 - Two each multi pin data RJ45 jacks installed.
 - Labeling of jacks.
 - Blank insert in vacant port.
2. CCS patch panel with RJ45 connectors installed.
3. Fiber optic CCS patch panel enclosure with cable management, optional splice trays and "LC" connectors installed.
4. 610 mm (2 ft.) section of each copper cable to be used with cable sweep tags as specified in paragraph 2.4.H and connectors installed.
5. 610 mm (2 ft.) section of each fiber optic cable to be used with cable sweep tags as specified in paragraph 2.4.H and connectors installed.
6. 610 mm (2 ft.) section of each analog RF, video coaxial cable to be used with cable sweep tags as specified in paragraph 2.4.H and connectors installed.

E. Certifications:

Submit written certification from the OEM indicating that the proposed supervisor of the installation and the proposed provider of the contract maintenance are authorized representatives of the OEM. Include the individual's exact name and address and OEM credentials in the certification.

Submit written certification from the OEM that the wiring and connection diagrams meet National and/or Government Life Safety Guidelines, NFPA, NEC, UL, this specification, and JCAHCO requirements and instructions, requirements, recommendations, and guidance set forth by the OEM for the proper performance of the System as described herein. The VA will not approve any submittal without this certification.

Preacceptance Certification: This certification shall be made in accordance with the test procedure outlined in paragraph 3.2.B.

F. Equipment Manuals: Fifteen (15) working days prior to the scheduled acceptance test, the Contractor shall deliver four complete sets of commercial operation and maintenance manuals for each item of equipment furnished as part of the System to the COTR. The manuals shall detail the theory of operation and shall include narrative descriptions, pictorial illustrations, block and schematic diagrams, and parts list.

G. Record Wiring Diagrams:

Fifteen (15) working days prior to the acceptance test, the Contractor shall deliver four complete sets of the Record Wiring Diagrams of the System to the COTR. The diagrams shall show all inputs and outputs of electronic and passive equipment correctly identified according to the markers installed on the interconnecting cables, Equipment and room/area locations.

The Record Wiring Diagrams shall be in hard copy and two compact disk (CD) copies properly formatted to match the Facility's current operating version of Computer Aided Drafting (AutoCAD) system. The COTR shall verify and inform the Contractor of the version of AutoCAD being used by the Facility.

H. Surveys Required As A Part Of The Technical Submittal: The Contractor shall provide the following surveys that depict various system features and capacities are required in addition to the on site survey requirements described herein. Each survey shall be in writing and contain the following information (the formats are suggestions and may be used for the initial Technical Submittal survey requirements), as a minimum:

1. Cable Distribution System Design Plan: A design plan for the entire cable distribution systems requirements shall be provided with this document. A specific cable count shall coincide with the total growth items as described herein. It is the Contractor's responsibility to provide the Systems entire cable requirements and engineer a distribution system requirement plan using the format of the following paragraph(s), at a minimum:

a. UTP (and/or STP) Requirements/Column Explanation:

Column	Explanation
FROM BUILDING	Identifies the building by number, title, or location, and main signal closet or intermediate signal closet cabling is provided from
BUILDING	Identifies the building by number, title, or location cabling is to be provided in
TO BUILDING IMC	Identifies building main terminal signal closet, by room number or location, to which cabling is provided too, in, and from
FLOOR	Identifies the floor by number (i.e. 1st, 2nd, etc.) cabling and TCOs are to be provided
TC ROOM NUMBER	Identifies the floor signal closet room, by room number, which cabling shall be provided
ROOM NUMBER	Identifies the room, by number, from which cabling and TCOs shall be provided
NUMBER OF CABLE PAIR	Identifies the number of cable pair required to be provided on each floor designated OR the number of cable pair (VA Owned) to be retained
NUMBER OF STRANDS USED/SPARE	Identifies the number of strands provided in each run

b. Fiber Optic Cabling Requirements/Column Explanation:

Column	Explanation
FROM BUILDING	Identifies the building by number, title, or location, and main signal closet or intermediate signal closet cabling is provided from
TO BUILDING IMC	Identifies building, by number, title, or location, to which cabling is provided
FLOOR	Identifies the floor by number (i.e. 1st, 2nd, etc.)
TC ROOM NUMBER	Identifies the room, by number, from which cabling shall be installed
NUMBER OF STRANDS	Identifies the number of strands in each run of fiber optic cable
INSTALLED METHOD	Identifies the method of installation in accordance with as designated herein
NOTES	Identifies a note number for a special feature or equipment
BUILDING MTC	Identifies the building by number or title

c. Analog RF Cabling Requirements/Column Explanation:

Column	Explanation
FLOOR	Identifies the floor by number (i.e. 1st,
TC ROOM NUMBER	Identifies the room, by number, from which cabling shall be installed
TO FLOOR TC	Identifies building, by number or location, to which cabling is installed
NUMBER OF STRANDS	Identifies the number of strands in each run of RF cable
INSTALLED METHOD	Identifies the method of installation in accordance with as designated herein
NOTES	Identifies a note number for a special feature or equipment
BUILDING MTC	Identifies the building by number or title

2. Telecommunication Outlets: The Contractor shall clearly and fully indicate this category for each outlet location and compare the total count to the locations identified above as a part of the technical submittal. Additionally, the Contractor shall indicate the total number of spares.

PART 2 - PRODUCTS**2.1 EQUIPMENT AND MATERIALS**

A. System Requirements:

1. The System shall provide the following minimum services that are designed in accordance with and supported by an Original Equipment Manufacturer (OEM), and as specified herein. The System shall provide continuous inter and/or intra-Facility voice and data, and analog RF service. The System shall be capacity sized so that loss of connectivity to external telephone systems shall not affect the Facilities operation in specific designated locations. The System shall:
 - a. Be capable of inter-connecting and functioning fully with the existing Local Telephone Exchange (LEC) Network(s), Federal Telephone System (FTS) Inter-city Network(s), Inter-exchange Carriers, Integrated Services Digital Network (ISDN), Electronic Private Branch Exchange (EPBX) switches, asynchronous/synchronous data terminals and circuits including Automatic Transfer Mode (ATM), Frame Relay, and local area networks (LAN), at a minimum.

Be a voice and data cable distribution system that is based on a physical "Star" Topology. An Analog RF coaxial cable distribution system shall be provided in a "home run" configuration from each associated riser TC to identified locations and as shown on the drawings.

Be compatible with and able to provide direct digital connection to trunk level equipment including, but, not limited to: directly accessing trunk level equipment including the telephone system, audio paging, Industry Standard "T" and/or "DS" carrier services and external protocol converters. Additionally, connections to "T" and/or "DS" access/equipment or Customer Service Units (CSU) that are used in FTS and other trunk applications shall be included in the System design. Provide T-1 access/equipment (or CSU), as required for use, in FTS and other trunk applications by system design if this equipment is not provided by the existing telephone system and/or will be deactivated by the installation of the System. The Contractor shall provide all T-1 equipment necessary to terminate and make operational the quantity of circuits designated. The CSU's shall be connected to the System's emergency battery power supply. The System shall be fully capable of operating in the Industry Standard "DS" protocol and provide that service when required.

2. Specific Subsystem Requirements: The System shall consist, as a minimum, of the following independent sub-systems to comprise a complete and functional voice and digital and analog RF telecommunications cabling system: "Main" (MTC), "intermediate" (IMTC), and "riser" (RTC) TC's; "vertical" (or "riser") trunk cabling system; vertical cross-connection (VCC) cabling systems, and TCO's with a minimum of three (3) RJ-45 jacks for the appropriate telephone, Data connections, and additional jacks, connectors, drop and patch cords, terminators, and adapters provided.

a. Telecommunication Closet (TC):

- 1) There shall be a minimum of one TC for the MTC, each building IMTC, and each RTC per building floor location. However, in large building(s), where the horizontal distance to the farthest voice and digital work area may exceed 90 Meters (M) (or 295 feet [ft]), additional TC's shall be provided as described herein. The maximum DC resistance per cable pair

shall be no more than 28.6 Ohms per 305 M (1,000 feet). The TC's house in cabinets or enclosures, on relay racks, and/or on backboards, various telecommunication data equipment, controllers, multiplexers, bridges, routers, LAN hub(s), telephone cross-connecting, active and passive equipment.

- 2) Additionally, the TC's may house fire alarm, nurses call, code one (or blue), video, public address, radio entertainment, intercom, and radio paging equipment. Regardless of the method of installation, mounting, termination, or cross-connecting used, all vertical copper and fiber optic and analog RF coaxial cables shall be terminated on appropriate cross-connection systems (CCS) containing patch panel(s), punch blocks, and/or breakout devices provided in enclosures and tested as described herein. A cable and/or wire management system shall be a part of each CCS.

A minimum of three 110-120 VAC active quad outlets shall be provided, each with "U" grounded receptacles at a minimum of one outlet for each front, side and back wall. These outlets shall be separately protected by an AC circuit breaker provided in the designated Government Emergency Critical Care AC power panel, that is connected to the Facilities Emergency AC Power Distribution System. For larger building TC applications, a minimum of one additional quad AC outlet shall be provided for every 800M² (or 8,000 ft²) of useable floor space. Additional outlets shall be equally spaced along the wall.

Climate control shall be provided in each TC 24 hours a day, seven days per week and 52 week per year to prevent failure of electronic components and for mission critical functional applications. The COTR is responsible for informing the Contractor regarding the minimum climate control requirements. In identified hostile TC locations where it has been determined (by the COTR) that proper TC climate or external signal radiation cannot be properly maintained or controlled, the Contractor may, at his/her option, provide a minimum of two individual and properly sized self contained climate controlled equipment cabinet enclosures; one designated for voice, and data, and one

additional cabinet designated for analog RF service, in each TC location identified on the drawings, in lieu of providing additional required TC air handling capability. B.

System Performance:

1. At a minimum, the System shall be able to support the following voice and data and analog RF operations for Category 6 Certified Telecommunication Service:
 - a. Provide the following interchange (or interface) capabilities:
 - Basic Rate (BRI).
 - Primary Rate (PRI).
 - b. ISDN:
 - 1) Narrow Band BRI.
 - B Channel: 64 kilo-Bits per second (kBps), minimum.
 - D Channel: 16 kBps, minimum.
 - H Channel: 384 kBps, minimum.
 - 2) Narrow Band PRI:
 - B Channel: 64 kBps, minimum.
 - D Channel: 64 kBps, minimum.
 - H Channel: 1,920 kBps, minimum.
 - 3) Wide (or Broad) Band:
 - a) All channels: 140 mega (m)-Bps, minimum, capable to 565 mBps at "T" reference.
 - c. ATM operation and interface: ATM 155 mBps
 - d. Frame Relay: All stated compliance's.
 - e. Integrated Data Communications Utility (IDCU) operation and interface.
 - f. Government Open Systems Interconnection Profile (GOSSIP) compliant.
 - g. Fiberoptic Distributed Data Interface (FDDI): A minimum 100 Mb/s to a maximum of 1.8 giga(g)-Bps data bit stream speed (shall be Synchronous Optical Network [Sonet] compliant).
 - h. System Sensitivity: Satisfactory service shall be provided for at least 3,000 feet for all voice and data and analog RF locations.
2. At a minimum the System shall support the following operating parameters:
 - a. EPBX connection:
 - System speed: 1.0 Gb/s per second, minimum.
 - Impedance: 600 Ohms.

Cross Modulation: -60 deci-Bel (dB).

Hum Modulation: -55 Db.

System data error: 10 to the -10 Bps, minimum loss measured at the frame output with reference Zero (0) deciBel measured (dBm) at 1,000 Hertz (Hz) applied to the frame input.

Trunk to station: 1.5 dB, maximum.

Station to station: 3.0 dB, maximum.

Internal switch crosstalk: -60 dB when a signal of + 10 deciBel measured (dBm), 500-2,500 Hz range is applied to the primary path.

Idle channel noise: 25 dBm "C" or 3.0 dBm "O" above reference (terminated) ground noise, whichever is greater.

Traffic Grade of Service for Voice and Data:

A minimum grade of service of P-01 with an average traffic load of 7.0 CCS per station per hour and a traffic overload in the data circuits will not interfere with, or degrade, the voice service.

Average CCS per voice station: The average CCS capacity per voice station shall be maintained at 7.0 CCS when the EPBX is expanded up to the projected maximum growth as stated herein.

b. Telecommunications Outlet (TCO):

1) Voice:

Isolation (outlet-outlet): 24 dB.

Impedance: 600 Ohms, balanced (BAL).

Signal Level: 0 deciBel per mili-Volt (dBmV) + 0.1 dBmV.

System speed: 1 Gb/s, minimum.

System data error: 10 to the -6 Bps, minimum.

2) Data:

Isolation (outlet-outlet): 24 dB.

Impedance: 600 Ohms, BAL.

Signal Level: 0 dBmV + 0.1 dBmV.

System speed: 1 Gb/s, minimum.

System data error: 10 to the -8 Bps, minimum.

3) Fiber optic:

Isolation (outlet-outlet): 36 dB.

Signal Level: 0 dBmV + 0.1 dBmV.

System speed: 6 Gbls, minimum.

d) System data error: 10 to the -6 BPS, minimum.

- 4) Analog RF Service: Broadcast or "off air" RF (or television) analog service is considered to be at RF (below 900 MHz in frequency bandwidth). Usually a RF television circuits require a single coaxial cable plant from the headend to each TC location.

Isolation (outlet-outlet): 14 dB.

Impedance: 75 Ohms, Unbalanced (UNBAL).

Signal Level: 10 dBmV + 5.0 dBmV.

Bandwidth: 6.0 MHz per channel, fully loaded

C. General:

1. All equipment to be supplied under this specification shall be new and the current model of a standard product of an OEM or record. An OEM of record shall be defined as a company whose main occupation is the manufacture for sale of the items of equipment supplied and which:

Maintains a stock of replacement parts for the item submitted.

Maintains engineering drawings, specifications, and operating manuals for the items submitted.

Has published and distributed descriptive literature and equipment specifications on the items of equipment submitted at least 30 days prior to the Invitation for Bid.

2. Specifications of equipment as set forth in this document are minimum requirements, unless otherwise stated, and shall not be construed as limiting the overall quality, quantity, or performance characteristics of items furnished in the System. When the Contractor furnishes an item of equipment for which there is a specification contained herein, the item of equipment shall meet or exceed the specification for that item of equipment.
3. The Contractor shall provide written verification, in writing to the COTR at time of installation, that the type of wire/cable being provided is recommended and approved by the OEM. The Contractor is responsible for providing the proper size and type of cable duct and/or conduit and wiring even though the actual installation may be by another subcontractor.
4. The telephone equipment and PA interface equipment shall be the interface points for connection of the PA interface cabling from the telephone switch via the system telephone interface unit.

Active electronic component equipment shall consist of solid state components, be rated for continuous duty service, comply with the requirements of FCC standards for telephone equipment, systems, and service.

All passive distribution equipment shall meet or exceed -80 dB radiation shielding specifications.

All interconnecting twisted pair, fiber-optic or coaxial cables shall be terminated on equipment terminal boards, punch blocks, breakout boxes, splice blocks, and unused equipment ports/taps shall be terminated according to the OEM's instructions for telephone cable systems without adapters. The Contractor shall not leave unused or spare twisted pair wire, fiber-optic, or coaxial cable unterminated, unconnected, loose or unsecured.

Color code all distribution wiring to conform to the Telephone Industry standard, EIA/TIA, and this document, which ever is the more stringent. At a minimum, all equipment, cable duct and/or conduit, enclosures, wiring, terminals, and cables shall be clearly and permanently labeled according to and using the provided record drawings, to facilitate installation and maintenance. Reference Specification Section 27 10 00, STRUCTURED CABLING.

Connect the System's primary input AC power to the Facility' Critical Branch of the Emergency AC power distribution system as shown on the plans or if not shown on the plans consult with RE regarding a suitable circuit location prior to bidding.

Plug-in connectors shall be provided to connect all equipment, except coaxial cables and interface points. Coaxial cable distribution points and RF transmission lines shall use coaxial cable connections recommended by the cable OEM and approved by the System OEM. Base-band cable systems shall utilize barrier terminal screw type connectors, at a minimum. Crimp type connectors installed with a ratchet type installation tool are and acceptable alternate as long as the cable dress, pairs, shielding, grounding, and connections and labeling are provided the same as the barrier terminal strip connectors. Tape of any type, wire nuts, or solder type connections are unacceptable and will not be approved.

All equipment faceplates utilized in the System shall be stainless steel, anodized aluminum, or UL approved cycolac plastic for the areas where provided.

12. Noise filters and surge protectors shall be provided for each equipment interface cabinet, switch equipment cabinet, control console, local, and remote active equipment locations to ensure protection from input primary AC power surges and noise glitches are not induced into low Voltage data circuits.
13. Underground warning tape shall be standard, 4-Mil polyethylene 76 mm (3 inch) wide tape detectable orange with black letters imprinted with "CAUTION BURIED TELEPHONE LINE BELOW" or orange with black letters imprinted with "CAUTION BURIED FIBER OPTIC LINE BELOW", as applicable.

D. Equipment Functional Characteristics:

FUNCTIONS	CHARACTERISTICS
Input Voltage	105 to 130 VAC
POWER LINE FREQUENCY	60 HZ \pm 2.0 HZ
Operating Temperature	0 to 50 degrees ($^{\circ}$) Centigrade (C)
Humidity	80 percent (%) minimum rating

E. Equipment Standards and Testing:

The System has been defined herein as connected to systems identified as Critical Care performing Life Support Functions. Therefore, at a minimum, the system shall conform to all aforementioned National and/or Local Life Safety Codes (which ever are the more stringent), NFPA, NEC, this specification, JCAHCO Life Safety Accreditation requirements, and the OEM recommendations, instructions, and guidelines.

All supplies and materials shall be listed, labeled or certified by UL or a nationally recognized testing laboratory where such standards have been established for the supplies, materials or equipment. See paragraph minimum requirements Section 27 05 11, REQUIREMENTS FOR COMMUNICATIONS INSTALLATIONS, and the guidelines listed in paragraph 2.J.2.

The provided active and passive equipment required by the System design and approved technical submittal must conform with each UL standard in effect for the equipment, as of the date of the technical submittal (or the date when the RE approved system equipment necessary to be replaced) was technically reviewed and approved by VA. Where a UL standard is in existence for equipment to

be used in completion of this contract, the equipment must bear the approved UL seal.

4. Each item of electronic equipment to be provided under this contract must bear the approved UL seal or the seal of the testing laboratory that warrants the equipment has been tested in accordance with, and conforms to the specified standards.

2.2 EQUIPMENT ITEMS

A. Cabinet with Internal Equipment Mounting Rack:

The provided equipment cabinet shall be lockable, fabricated of heavy 16 gauge (ga) steel, and have fully adjustable internal equipment mounting racks or rails that allows front panel equipment mounting and access. It shall have baked-on iron phosphate primer and baked enamel paint finish in a color to be selected by the COTR. It shall be floor or wall mounted with knock-out holes for cable entrance and conduit connection, contain ventilation ports and a quiet fan with non disposable air filter for equipment cooling. Two keys shall be provided to the COTR for each lock when the VA accepts the System.

A minimum of one cabinet shall be provided with blank rack space, for additional equipment. Blank panels shall be installed to cover any open or unused rack space. In addition, provide two 120 VAC power strips connected to surge protectors, a ventilation fan with non-disposable air filter, and a conduit or cable duct interfaced to adjacent cabinet(s), as part of this cabinet.

Blank panels shall be color matched to the cabinet, 3.175 mm (1/8in.) aluminum with vertical dimensions in increments of one rack unit 45 mm (or 1.75in.) with mounting holes spaced to correspond to EIA 480 mm (or 19in.) rack dimensions. Single standard size blank panels shall be used to fill unused panel or rack spaces in lieu of numerous 45 mm (1.75in.) types. One blank 45 mm (1.75in.) high blank panel shall be installed between each item of equipment.

Technical Characteristics:

Overall Height	2180 mm (85 7/8in.), maximum
Overall Depth	650 mm (25 1/2in.), maximum
Overall Width	535 mm (21 1/16in.), maximum
Front Panel Opening Width	480 mm (19in.), EIA horizontal
Hole Spacing	per EIA and Industry Standards

5. Internal Cabinet Components (minimum required):

a. AC power outlet strip(s):

Power outlet strip(s) shall be provided as directed by the COTR. The additional equipment cabinet with no installed items in the cabinet, shall contain strip(s) with a minimum of 12 ea. AC power outlets. Each strip shall be mounted inside and at the rear of the cabinet. It shall contain "U" grounded AC outlets for distributing AC power to the installed electronic equipment. The strip shall be self-contained in a metal enclosure and may be provided with a 2 M (6 ft.) long (maximum) connecting cord with three prong plug.

Technical Characteristics:

Power capacity 20 Ampere (AMP), 120 VAC continuous duty.

Wire gauge: Three conductor, #12 AWG copper.

b. Cabinet AC Power Line Surge Protector and Filter:

Each cabinet shall be equipped with a AC Surge Protector and Filter. The Protector and Filter shall be housed in one single enclosure. The Protector and Filter shall perform instantaneous regulation of the AC input voltage and isolate and filter any noise present on the AC input line. The unit shall be equipped with AC voltage and current surge protectors to prevent damage to the electronic equipment from power line induced voltage spikes, surges, lightning, etc. It shall be cabinet mounted and the cabinet AC power strip (maximum of two strips) may be connected to it as long as the system design is met.

Technical Characteristics:

Input Voltage range	120 VAC + 15%
Power capacity	20 AMP, 120 VAC
Voltage output	+3.0%
Circuit breaker	15 AMP, may be self contain
Noise filtering	Greater than -45 dB
AC outlets	Four duplex grounded types, minimum
Response time	5.0 ns
Surge suppression	10,000 AMPS
Noise suppression	
Common	-40 dB
Differential	-45 dB

- 3) Specific requirements for current and surge protection shall include:
- a) Voltage protection threshold, line to neutral, starts at no more than 220 Volts peak. The transient voltage shall not exceed 300 volts peak. The Contractor shall furnish documentation on peak clamping voltage as a function of transient AMP.
 - b) Peak power dissipation minimum 35 Joules per phase, as measured for 1.0 mS at sub branch panels, 100 Joules per phase at branch panels and 300 Joules per phase at service entrance panels. The Contractor shall furnish an explanation of how the ratings were measured or empirically derived.
 - c) Surge protector must not short circuit the AC power line at any time.
The primary surge protection components must be silicon semiconductors. Secondary stages, if used, may include other types of devices.
Surge protectors shall incorporate a visual device which indicates whether the surge suppression component(s) is (are) functioning.
Surge protection devices shall be UL listed.
Voltage and current surge protectors shall be provided on all ancillary equipment provided by the Contractor.
 - d) Power dissipation 12,000 Watts (W) for 1.0 mS (or 12 Joules).
 - e) Voltage protection threshold starts at not more than 100 VAC.

B. Environmental Cabinet (if selected):

1. The Contractor shall provide this enclosure in lieu of a standard equipment cabinet identified in Paragraph 2.3.A to meet system design in hostile TC locations as identified on the drawings. The enclosure shall fully sustain the installed, including electronic, equipment in the same manner as the standard cabinet identified in Paragraph 2.3.A. Additionally, the enclosure shall fully support all installed equipment as if they were in a stand alone air handling area regardless of the local area's air handling capabilities. The enclosure shall be a OEM's fully assembled unit. If more than two

enclosures are required in any system location, those enclosures shall be OEM assembled for consolidating or combining two or more enclosures in a single unit to meet system space and equipment handling designs.

2. Technical Characteristics:

Environmental control	Automatic, heating and/or cooling, as required
Temperature conditions (rated at 1,300 W of installed equipment heat generation):	
Internal Range	Maintains 80° to 105° of internal heat conditions, maximum
External Range	100° + 25°, maximum
Forced air unit	Required with non disposable air filter unobstructed and uninterruptible
Air conditioning	As required, fully internal mounted
Heater	As required, fully internal mounted
Uninterruptible power supply	As required, fully internal mounted
Front door	Full length, see through, EMI resistant, and lockable
Rear door	Full length, non-see through, EMI resistant, and lockable
Conduit wiring entrance	TOP AND/OR BOTTOM, FULLY SEALED
Input power	2 ea. minimum 120 VAC @ 20A, maximum, independent circuit, conduit for fixed or armored cable for moveable installations
Dimensions:	
Height	1980 mm (78in.), maximum
Width	635 mm (25in.), maximum
Depth	965 mm (38in.), maximum
Front panel opening	480 mm (19in.), w/ EIA mounting hole spacing

C. Distribution or System Interface Cabinet:

1. The cabinet shall be constructed of heavy 16 gauge cold rolled steel, have top and side panels and hinged front and rear (front door only if wall mounted) doors. It shall have baked-on iron phosphate primer and baked enamel paint finish in a color to be selected by the COTR, contain integral and adjustable predrilled

rack mounting rails or frame that allows front panel equipment mounting and access. When all equipment, doors and panels are installed, snap-in-place chrome trim strip covers are required to be installed that will cover all front panel screw fasteners. It shall be equipped the same as the equipment cabinet.

2. Technical Characteristics:

Overall height	2180 mm (85 7/8in.), maximum
Overall depth	650 mm (25 1/2in.), maximum
Overall width	535 mm (21 1/16in.), maximum
Equipment vertical mounting space	1960 mm (77 1/8in.), maximum
Front panel horizontal	484 mm (19 1/16in.), maximum width

D. Stand Alone Equipment (or sometimes called Radio Relay) Rack:

The rack shall be constructed of heavy 16 gauge cold rolled steel and have fully adjustable equipment front mounting rails that allows front panel equipment mounting and access. It shall have baked-on iron phosphate primer and baked enamel paint finish in a color to be selected by the COTR. It shall be floor or wall mounted or mounted on casters as directed by the COTR.

Technical Characteristics:

Overall Height	2180 mm (85 7/8in.), maximum
Overall Depth	650 mm (25 1/2in.), maximum
Overall Width	535 mm (21 1/16in.), maximum
Front Panel Opening	480 mm (19in.), EIA horizontal width
Hole Spacing	per EIA and Industry Standards

E. Cross-Connection System (CCS) Equipment Breakout, Termination Connector (or Bulkhead), and Patch Panels:

1. The connector panel(s) shall be made of flat smooth 3.175 mm (1/8 in.) thick solid aluminum, custom designed, fitted and installed in the cabinet. Bulkhead equipment connectors shall be mounted on the panel to enable all cabinet equipment's signal, control, and coaxial cables to be connected through the panel. Each panel shall be color matched to the cabinet installed.

a. Voice (or Telephone):

- 1) The CSS for voice or telephone service shall be Industry Standard type 110 (minimum) punch blocks for voice or

telephone, and control wiring in lieu of patch panels, each being certified for category six service. IDC punch blocks (with internal RJ45 jacks) are acceptable for use in all CCS and shall be specifically designed for category six telecommunications service and the size and type of UTP cable used as described herein. As a minimum, punch block strips shall be secured to an OEM designed physical anchoring unit on a wall location in the MTC, IMTC, RTC, and TC. However, console, cabinet, rail, panel, etc. mounting is allowed at the OEM recommendation and as approved by the RE. Punch blocks shall not be used for Class II or 120 VAC power wiring.

2) Technical Characteristics:

Number of horizontal rows	100, MINIMUM
Number of terminals per row	4, minimum
Terminal protector	required for each used or unused terminal
Insulation splicing	required between each row of terminals

b. Digital or High Speed Data:

The CSS for digital or high-speed data service shall be a patch panel with modular female RJ45 jacks installed in rows. Patch panels and RJ45 jacks shall be specifically designed for category six telecommunications service and the size and type of UTP or STP cable used. Each panel shall be 480 mm (19in.) horizontal EIA rack mountable dimensions with EIA standard spaced vertical mounting holes.

Technical Characteristics:

Number of horizontal rows	2, minimum
Number of jacks per row	24, MINIMUM
Type of jacks	RJ45
Terminal protector	required for each used or unused jack
Insulation	required between each row of jacks

c. Fiber optic:

Product reference of a Government Approved (US State Department) type is Telewire, PUP-17 with pre-punched chassis mounting holes arranged in two horizontal rows. This panel may be used for fiber optic, audio, control cable, and Class II Low Voltage Wiring installations when provided with the proper connectors. This panel is not allowed to be used for 120 VAC power connections.

Technical Characteristics:

Height	Two rack units (RUs), 88 mm (3.5in.) minimum
Width	484 mm (19 1/16in.), EIA minimum
Number of connections	24 pairs, minimum
Connectors	LC
Control Signal Service	Barrier strips surface mounted with spade lugs (punch block or wire wrap type strips are acceptable alternates for barrier strips as long as system design is maintained and RE approved)
Low voltage power (class II)	Barrier strips with spade lugs and clear full length plastic cover, surfaced mounted
Fiber optic	"LC" ceramic female

d. Mounting Strips and Blocks:

1) Barrier Strips: Barrier strips are approved for AC power, data, voice, and control cable or wires. Barrier strips shall accommodate the size and type of audio spade (or fork type) lugs used with insulating and separating strips between the terminals for securing separate wires in a neat and orderly fashion. Each cable or wire end shall be provided with an audio spade lug, which is connected to an individual screw terminal on the barrier strip. The barrier strips shall be surface secured to a console, cabinet, rail, panel, etc. 120 VAC power wires shall not be connected to signal barrier strips.

2) Technical Characteristics:

Terminal size	6-32, minimum
Terminal Count	ANY COMBINATION
Wire size	20 AWG, minimum
Voltage handling	100 V, minimum
Protective connector cover	Required for Class II and 120 VAC power connections

Solderless Connectors: The connectors (or fork connectors) shall be crimp-on insulated lug to fit a 6-32 minimum screw terminal. The fork connector shall be installed using a standard lug-crimping tool.

Punch Blocks: As a minimum, Industry Standard 110 type punch blocks are approved for data, voice, and control wiring. Punch blocks shall be specifically designed for the size and type of wire used. Punch block strips shall be secured to a console, cabinet, rail, panel, etc. Punch blocks shall not be used for Class II or 120 VAC power wiring.

F. Wire Management System and Equipment:

Wire Management System: The system(s) shall be provided as the management center of the respective cable system, CCS, and TC it is incorporated. It shall perform as a platform to house peripheral equipment in a standard relay rack or equipment cabinet. It shall be arranged in a manner as to provide convenient access to all installed management and other equipment. All cables and connections shall be at the rear of each system interface to IDC and/or patch panels, punch blocks, and/or barrier strip.

Wire Management Equipment: The wire management equipment shall be the focal point of each wire management system. It shall provide an orderly interface between outside and inside wires and cables (where used), distribution and interface wires and cables, interconnection wires and cables and associated equipment, jumper cables, and provide a uniform connection media for all system fire retardant wires and cables and other subsystems. It shall be fully compatible and interface to each cable tray, duct, wireway, or conduit used in the system. All interconnection or distribution wires and cables shall enter the system at the top (or from a wireway in the floor)

via a overhead protection system and be uniformly routed down either side (or both at the same time) of the frames side protection system then laterally via a anchoring or routing shelf for termination on the rear of each respective terminating assembly. Each system shall be custom configured to meet the System design and user needs.

2.3 ENVIRONMENTAL REQUIREMENTS

Technical submittals shall identify the environmental specifications for housing the system. These environmental specifications shall identify the requirements for initial and expanded system configurations for:

Floor loading for batteries and cabinets.

Minimum floor space and ceiling heights.

Minimum size of doors for equipment passage.

Power requirements: The bidders shall provide the specific voltage, amperage, phases, and quantities of circuits required.

Air conditioning, heating, and humidity requirements. The bidder shall identify the ambient temperature and relative humidity operating ranges required preventing equipment damage.

Air conditioning requirements (expressed in BTU per hour, based on adequate dissipation of generated heat to maintain required room and equipment standards).

Proposed floor plan based on the expanded system configuration.

Conduit size requirement.

2.4 INSTALLATION KIT

The kit shall be provided that, at a minimum, includes all connectors and terminals, labeling systems, audio spade lugs, barrier strips, punch blocks or wire wrap terminals, heat shrink tubing, cable ties, solder, hangers, clamps, bolts, conduit, cable duct, and/or cable tray, etc., required to accomplish a neat and secure installation. All wires shall terminate in a spade lug and barrier strip, wire wrap terminal or punch block. Unfinished or unlabeled wire connections shall not be allowed. Turn over to the COTR all unused and partially opened installation kit boxes, coaxial, fiberoptic, and twisted pair cable reels, conduit, cable tray, and/or cable duct bundles, wire rolls, physical installation hardware. The following are the minimum required installation sub-kits:

A. System Grounding:

The grounding kit shall include all cable and installation hardware required. All radio equipment shall be connected to earth ground via internal building wiring, according to the NEC.

This includes, but is not limited to:

- Coaxial Cable Shields.
- Control Cable Shields.
- Data Cable Shields.
- Equipment Racks.
- Equipment Cabinets.
- Conduits.
- Duct.
- Cable Trays.
- Power Panels.
- Connector Panels.
- Grounding Blocks.

- B. Coaxial Cable: The coaxial cable kit shall include all coaxial connectors, cable tying straps, heat shrink tabbing, hangers, clamps, etc., required to accomplish a neat and secure installation.
- C. Wire and Cable: The wire and cable kit shall include all connectors and terminals, audio spade lugs, barrier straps, punch blocks, wire wrap strips, heat shrink tubing, tie wraps, solder, hangers, clamps, labels etc., required to accomplish a neat and orderly installation.
- D. Conduit, Cable Duct, and Cable Tray: The kit shall include all conduit, duct, trays, junction boxes, back boxes, cover plates, feed through nipples, hangers, clamps, other hardware required to accomplish a neat and secure conduit, cable duct, and/or cable tray installation in accordance with the NEC and this document.
- E. Equipment Interface: The equipment kit shall include any item or quantity of equipment, cable, mounting hardware and materials needed to interface the systems with the identified sub-system(s) according to the OEM requirements and this document.
- F. Labels: The labeling kit shall include any item or quantity of labels, tools, stencils, and materials needed to completely and correctly label each subsystem according to the OEM requirements, as-installed drawings, and this document.
- G. Documentation: The documentation kit shall include any item or quantity of items, computer discs, as installed drawings, equipment,

maintenance, and operation manuals, and OEM materials needed to completely and correctly provide the system documentation as required by this document and explained herein.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Product Delivery, Storage and Handling:

Delivery: Deliver materials to the job site in OEM's original unopened containers, clearly labeled with the OEM's name and equipment catalog numbers, model and serial identification numbers. The COTR may inventory the cable, patch panels, and related equipment.

Storage and Handling: Store and protect equipment in a manner, which will preclude damage as directed by the COTR.

B. System Installation:

After the contract's been awarded, and within the time period specified in the contract, the Contractor shall deliver the total system in a manner that fully complies with the requirements of this specification. The Contractor shall make no substitutions or changes in the System without written approval from the COTR.

The Contractor shall install all equipment and systems in a manner that complies with accepted industry standards of good practice, OEM instructions, the requirements of this specification, and in a manner which does not constitute a safety hazard. The Contractor shall insure that all installation personnel understands and complies with all the requirements of this specification.

The Contractor shall install suitable filters, traps, directional couplers, splitters, TC's, and pads for minimizing interference and for balancing the System. Items used for balancing and minimizing interference shall be able to pass telephone and data, lightwave, and analog signals in the frequency bands selected, in the direction specified, with low loss, and high isolation, and with minimal delay of specified frequencies and signals. The Contractor shall provide all equipment necessary to meet the requirements of Paragraph 2.1.C and the System performance standards.

All passive equipment shall be connected according to the OEM's specifications to insure future correct termination, isolation, impedance match, and signal level balance at each telephone/data outlet.

Where TCOs are installed adjacent to each other, install one outlet for each instrument.

All lines shall be terminated in a suitable manner to facilitate future expansion of the System. There shall be a minimum of one spare 25 pair cable at each distribution point on each floor.

All vertical copper and fiber optic, and coaxial cables shall be terminated so any future changes only requires modifications of the existing EPBX or signal closet equipment only.

Terminating resistors or devices shall be used to terminate all unused branches, outlets, equipment ports of the System, and shall be devices designed for the purpose of terminating fiber optic or twisted pair, and coaxial, and lightwave cables carrying telephone and data, and analog signals in telephone and data, and analog video, and lightwave systems.

Equipment installed outdoors shall be weatherproof or installed in weatherproof enclosures with hinged doors and locks with two keys.

Equipment installed indoors shall be installed in metal cabinets with hinged doors and locks with two keys.

C. Conduit and Signal Ducts:

1. Conduit:

The Contractor shall employ the latest installation practices and materials. The Contractor shall provide conduit, junction boxes, connectors, sleeves, weatherheads, pitch pockets, and associated sealing materials not specifically identified in this document as GFE. Conduit penetrations of walls, ceilings, floors, interstitial space, fire barriers, etc., shall be sleeved and sealed. The minimum conduit size shall be 26 mm (1 in.).

All cables shall be installed in separate conduit and/or signal ducts (exception from the separate conduit requirement to allow telephone cables to be installed in partitioned cable tray with data cables may be granted in writing by the COTR if requested.) Conduits shall be provided in accordance with Section 27 05 33, RACEWAYS AND BOXES FOR COMMUNICATIONS SYSTEMS, and NEC Articles 517 for Critical Care and 800 for Communications systems, at a minimum.

When metal, plastic covered, etc., flexible cable protective armor or systems are specifically authorized to be provided for use in the System, their installation guidelines and standards

shall be as specified herein, Section 27 05 33, RACEWAYS AND BOXES FOR COMMUNICATIONS SYSTEMS, and the NEC.

When "innerduct" flexible cable protective systems is specifically authorized to be provided for use in the System, it's installation guidelines and standards shall be as the specified herein, Section 27 05 33, RACEWAYS AND BOXES FOR COMMUNICATIONS SYSTEMS, and the NEC.

Conduit (including GFE) fill shall not exceed 40%. Each conduit end shall be equipped with a protective insulator or sleeve to cover the conduit end, connection nut or clamp, to protect the wire or cable during installation and remaining in the conduit.

When metal, plastic covered, etc., flexible cable protective armor or systems are specifically authorized to be provided for use in the System, their installation guidelines and standards shall be as specified herein, Section 27 05 33, RACEWAYS AND BOXES FOR COMMUNICATIONS SYSTEMS, and the NEC.

Ensure that Critical Care, PA, and Radio Paging Systems (as identified by NEC Section 517) are completely separated and protected from all other systems.

2. Signal Duct, Cable Duct, or Cable Tray:

The Contractor shall use existing signal duct, cable duct, and/or cable tray, when identified and approved by the COTR.

Approved signal and/or cable duct shall be a minimum size of 100 mm x 100 mm (4 in. X 4 in.) inside diameter with removable tops or sides, as appropriate. Protective sleeves, guides or barriers are required on all sharp corners, openings, anchors, bolts or screw ends, junction, interface and connection points.

Approved cable tray shall be fully covered, mechanically and physically partitioned for multiple electronic circuit use, and be UL certified and labeled for use with telecommunication circuits and/or systems. The COTR shall approve width and height dimensions.

F. Connectors: Circuits, transmission lines, and signal extensions shall have continuity, correct connection and polarity. A uniform polarity shall be maintained between all points in the system.

1. Wires:

Wire ends shall be neatly formed and where insulation has been cut, heat shrink tubing shall be employed to secure the insulation on each wire. Tape of any type is not acceptable. Audio spade lugs shall be installed on each wire (including spare or unused) end and connect to screw terminals of appropriate size barrier strips. AC barrier strips shall be provided with a protective cover to prevent accidental contact with wires carrying live AC current. Punch blocks are approved for signal, not AC wires. Wire Nut or "Scotch Lock" connectors are not acceptable for signal wire installation.

Cables: Each connector shall be designed for the specific size cable being used and installed with the OEM's approved installation tool. Typical system cable connectors include; but, are not limited to: Audio spade lug, punch block, etc.

Speaker Line Audio:

Each connector shall be installed according to the cable, transformer or speaker OEM instructions and using the OEM's approved installation tool. The Contractor shall ensure each speaker is properly phased and connected in the same manner throughout the System using two conductor type wires.

One of the conductors shall be color coded to aid in establishing speaker signal polarity. Each speaker line shall be permanently soldered or audio spade lug connected to each appropriate speaker or line matching transformer connection terminal. Speaker line connection to each audio amplifier shall use audio spade lugs, as described herein.

AC Power: AC power wiring shall be run separately from signal cable.

Grounding:

1. General: The Contractor shall ground all Contractor Installed Equipment and identified Government Furnished Equipment to eliminate all shock hazards and to minimize, to the maximum extent possible, all ground loops, common mode returns, noise pickup, crosstalk, etc. The total ground resistance shall be 0.1 Ohm or less.

The Contractor shall install lightning arrestors and grounding in accordance with the NFPA and this specification.

Gas protection devices shall be provided on all metallic circuits and cable pairs serving building distribution frames located in buildings served by an unprotected distribution system (manhole,

aerial, etc.). The Contractor shall install the gas protection devices at the nearest point of entrance in buildings where protection is required.

Under no conditions shall the AC neutral, either in a power panel or in a receptacle outlet, be used for system control, subcarrier or audio reference ground.

The use of conduit, signal duct or cable trays as system or electrical ground is not acceptable and will not be permitted. These items may be used only for the dissipation of internally generated static charges (not to be confused with externally generated lightning) that may applied or generated outside the mechanical and/or physical confines of the System to earth ground. The discovery of improper system grounding shall be grounds to declare the System unacceptable and the termination of all system acceptance testing.

Cabinet Buss: A common ground buss of at least #10 AWG solid copper wire shall extend throughout each equipment cabinet and be connected to the system ground. Provide a separate isolated ground connection from each equipment cabinet ground buss to the system ground. Do not tie equipment ground busses together.

Equipment: Equipment shall be bonded to the cabinet bus with copper braid equivalent to at least #12 AWG. Self grounding equipment enclosures, racks or cabinets, that provide OEM certified functional ground connections through physical contact with installed equipment, are acceptable alternates.

Cable Shields: Cable shields shall be bonded to the cabinet ground buss with #6 AWG minimum stranded copper wire. Cable shields shall be insulated from each other, faceplates, equipment racks, consoles, enclosures or cabinets; except, at the system common ground point. Coaxial and audio cables, shall have one ground connection at the source; in all cases, cable shield ground connections shall be kept to a minimum.

I. Equipment Assembly:

1. Cabinets:

- a. Each enclosure shall be: floor or wall mounted with standard knockout holes for conduit connections or cable entrance; provide for ventilation of the equipment; have front and rear locking doors (except wall mounted cabinets that require only a front

locking door); power outlet strip(s), and connector or patch panel(s).

Rack (including freestanding radio relay) mounted equipment shall be installed in the enclosure's equipment adjustable mounting racks with equipment normally requiring adjustment or observation mounted so operational adjustment(s) can be conveniently made. Heavy equipment shall be mounted with rack slides or rails allowing servicing from the front of the enclosure. Heavy equipment shall not depend only upon front panel mounting screws for support. Equipment shall be provided with sufficient cable slack to permit servicing by removal of the installed equipment from the front of the enclosure. A color matched blank panel (spacer) of 44 mm (1.75 in.) high, shall be installed between each piece of equipment (active or passive) to insure adequate air circulation. The enclosure shall be designed for efficient equipment cooling and air ventilation. Each console or cabinet shall be equipped with a quiet fan and nondisposable air filter.

Enclosures and racks shall be installed plumb and square. Each shall be permanently attached to the building structure and held firmly in place. Fifteen inches of front vertical space opening shall be provided for additional equipment.

Signal connector, patch, and bulkhead panels (i.e.: audio, data, control, analog video, etc.) shall be connected so that outputs from each source, device or system component shall enter the panel at the top row of jacks, beginning left to right as viewed from the front, which will be called "inputs". Each connection to a load, device or system component shall exit the panel at the bottom row of jacks, beginning left to right as viewed from the front, which will be called "outputs".

Equipment located indoors shall be installed in metal racks or enclosures with hinged doors to allow access for maintenance without causing interference to other nearby equipment.

Cables shall enter the equipment racks or enclosures in such a manner that allows all doors or access panels to open and close without disturbing or damaging the cables.

All distribution hardware shall be securely mounted in a manner that allows access to the connections for testing and

provides sufficient room for the doors or access panels to open and close without disturbing the cables.

J. Labeling: Provide labeling in accordance with ANSI/EIA/TIA-606-A.

All lettering for voice and data circuits shall be stenciled using laser printers. Handwritten labels are not acceptable.

Cable and Wires (Hereinafter referred to as "Cable"): Cables shall be labeled at both ends in accordance with ANSI/EIA/TIA-606-A. Labels shall be permanent in contrasting colors. Cables shall be identified according to the System "Record Wiring Diagrams".

Equipment: System equipment shall be permanently labeled with contrasting plastic laminate or bakelite material. System equipment shall be labeled on the face of the unit corresponding to its source.

Conduit, Cable Duct, and/or Cable Tray: The Contractor shall label all conduit, duct and tray, including utilized GFE, with permanent marking devices or spray painted stenciling a minimum of 3 meters (10 ft.) identifying it as the System. In addition, each enclosure shall be labeled according to this standard.

Termination Hardware: The Contractor shall label workstation outlets and patch panel connections using color coded labels with identifiers in accordance with ANSI/EIA/TIA-606-A and the "Record Wiring Diagrams".

3.2 TESTS

A. Interim Inspection:

This inspection shall verify that the equipment provided adheres to the installation requirements of this document. The interim inspection will be conducted by a factory-certified representative and witnessed by a Government Representative. Each item of installed equipment shall be checked to insure appropriate UL certification markings. This inspection shall verify cabling terminations in telecommunications rooms and at workstations adhere to color code for T568A pin assignments and cabling connections are in compliance with ANSI/EIA/TIA standards. Visually confirm Category 6 marking of outlets, faceplates, outlet/connectors and patch cords.

Perform fiber optical field inspection tests via attenuation measurements on factory reels and provide results along with manufacturer certification for factory reel tests. Remove failed cable reels from project site upon attenuation test failure.

The Contractor shall notify the COTR, in writing, of the estimated date the Contractor expects to be ready for the interim inspection, at least 20 working days before the requested inspection date.

Results of the interim inspection shall be provided to the COTR. If major or multiple deficiencies are discovered, a second interim inspection may be required before permitting the Contractor to continue with the system installation.

The COTR shall determine if an additional inspection is required, or if the Contractor will be allowed to proceed with the installation. In either case, re-inspection of the deficiencies noted during the interim inspection(s), will be part of the proof of performance test. The interim inspection shall not affect the Systems' completion date. The COTR shall ensure all test documents will become a part of the Systems record documentation.

B. Pretesting:

1. Upon completing the installation of the System, the Contractor shall align and balance the system. The Contractor shall pretest the entire system.

2. Pretesting Procedure:

During the system pretest, the Contractor shall verify (utilizing the approved spectrum analyzer and test equipment) that the System is fully operational and meets all the system performance requirements of this standard.

The Contractor shall pretest and verify that all System functions and specification requirements are met and operational, no unwanted aural effects, such as signal distortion, noise pulses, glitches, audio hum, poling noise, etc. are present. The Contractor shall measure and record the aural carrier levels of each system telephone and data channel, at each of the following points in the system:

MDF interfaces or inputs and outputs.

Signal Level at each interface point to the distribution system, the last outlet on each trunk line plus all outlets installed as part of this contract.

3. The Contractor shall provide four (4) copies of the recorded system pretest measurements and the written certification that the System is ready for the formal acceptance test shall be submitted to the COTR.

C. Acceptance Test:

1. After the System has been pretested and the Contractor has submitted the pretest results and certification to the COTR, then the Contractor shall schedule an acceptance test date and give the RE 30 days written notice prior to the date the acceptance test is expected to begin. The System shall be tested in the presence of a Government Representative and an OEM certified representative. The System shall be tested utilizing the approved test equipment to certify proof of performance and Life Safety compliance. The test shall verify that the total System meets the requirements of this specification. The notification of the acceptance test shall include the expected length (in time) of the test.

D. Verification Tests:

Test the UTP copper cabling for DC loop resistance, shorts, opens, intermittent faults, and polarity between conductors, and between conductors and shield, if cable has an overall shield. Test the operation of shorting bars in connection blocks. Test cables after termination and prior to cross-connection.

Multimode Fiber Optic Cable: Perform end-to-end attenuation tests in accordance with ANSI/EIA/TIA-568-C.3 and ANSI/EIA/TIA-526-14A using Method A, Optical Power Meter and Light Source and Method B, OTDR. Perform verification acceptance test.

Single mode Fiber Optic Cable: Perform end-to-end attenuation tests in accordance with ANSI/EIA/TIA-568-C.3 and ANSI/EIA/TIA-526-7 using Method A, Optical Power Meter and Light Source and/or Method B, OTDR. Perform verification acceptance test.

E. Performance Testing:

Perform Category 6 tests in accordance with ANSI/EIA/TIA-568-C.1 and ANSI/EIA/TIA-568-C.2. Test shall include the following: wire map, length, insertion loss, return loss, NEXT, PSNEXT, ELFEXT, PSELFEXT, propagation delay and delay skew.

Fiber Optic Links: Perform end-to-end fiber optic cable link tests in accordance with ANSI/EIA/TIA-568-C.3.

- F. Total System Acceptance Test: The Contractor shall perform verification tests for UTP copper cabling system(s) and the multimode and single mode fiber optic cabling system(s) after the complete telecommunication distribution system and workstation outlet are installed.

3.3 TRAINING

Furnish the services of a factory-trained engineer or technician for a total of two four hour classes to instruct designated Facility IRM personnel. Instruction shall include cross connection, corrective, and preventive maintenance of the System and equipment.

Before the System can be accepted by the VA, this training must be accomplished. Training will be scheduled at the convenience of the COTR.

3.4 GUARANTEE PERIOD OF SERVICE

A. Contractor's Responsibilities:

The Contractor shall guarantee that all installed material and equipment will be free from defects, workmanship, and will remain so for a period of one year from date of final acceptance of the System by the VA. The Contractor shall provide OEM's equipment warranty documents, to the COTR if the Facility has taken possession of the building(s)), that certifies each item of equipment installed conforms to OEM published specifications.

The Contractor's maintenance personnel shall have the ability to contact the Contractor and OEM for emergency maintenance and logistic assistance, remote diagnostic testing, and assistance in resolving technical problems at any time. The Contractor and OEM shall provide this contact capability at no additional cost to the VA.

All Contractor installation, maintenance, and supervisor personnel shall be fully qualified by the OEM and must provide two (2) copies of current and qualified OEM training certificates and OEM certification upon request.

Additionally, the Contractor shall accomplish the following minimum requirements during the one year guarantee period: a. Response Time:

The COTR if the facility has taken possession of the building(s)) are the Contractor's reporting and contact officials for the System trouble calls, during the guarantee period.

A standard workweek is considered 8:00 A.M. to 5:00 P.M., Monday through Friday exclusive of Federal Holidays.

The Contractor shall respond and correct on-site trouble calls, during the standard work week to:

A routine trouble call within one working days of its report. A routine trouble is considered a trouble which causes a system outlet, station, or patch cord to be inoperable.

An emergency trouble call within 6 hours of its report. An emergency trouble is considered a trouble which causes a subsystem or distribution point to be inoperable at anytime. Additionally, the loss of a minimum of 50 station or system lines shall be deemed as this type of a trouble call.

- 4) The Contractor shall respond on-site to a catastrophic trouble call within 4 hours of its report. A catastrophic trouble call is considered total system failure.

If a system failure cannot be corrected within four hours (exclusive of the standard work time limits), the Contractor shall be responsible for providing alternate system CSS or TCO equipment, or cables. The alternate equipment and/or cables shall be operational within four hours after the four hour trouble shooting time.

Routine or emergency trouble calls in critical emergency health care facilities (i.e., cardiac arrest, intensive care units, etc.) shall also be deemed as a catastrophic trouble call if so determined by the COTR. The COTR shall notify the Contractor of this type of trouble call at the direction of the Facilities Director.

- b. Required on-site visits during the one year guarantee period 1)

The Contractor shall visit, on-site, for a minimum of eight hours, once every 12 weeks, during the guarantee period, to perform system preventive maintenance, equipment cleaning, and operational adjustments to maintain the System according the descriptions identified in this Section.

The Contractor shall arrange all Facility visits with the COTR prior to performing the required maintenance visits. The Contractor in accordance with the OEM's recommended practice and service intervals shall perform preventive maintenance during a non-busy time agreed to by the COTR and the Contractor.

The preventive maintenance schedule, functions and reports shall be provided to and approved by the COTR.

- 2) The Contractor shall provide the COTR a type written report itemizing each deficiency found and the corrective action performed during each required visit or official reported trouble call. The Contractor shall provide the COTR with sample copies of these reports for review and approval at the beginning of the Total System Acceptance Test. The following reports are the minimum required:

Monthly Report: The Contractor shall provide a monthly summary all equipment and sub-systems serviced during this guarantee period to COTR by the fifth working day after the end of each month. The report shall clearly and concisely describe the services rendered, parts replaced and repairs performed. The report shall prescribe anticipated future needs of the equipment and Systems for preventive and predictive maintenance

Contractor Log: The Contractor shall maintain a separate log entry for each item of equipment and each sub-system of the System. The log shall list dates and times of all scheduled, routine, and emergency calls. Each emergency call shall be described with details of the nature and causes of emergency steps taken to rectify the situation and specific recommendations to avoid such conditions in the future.

- 3) The COTR shall provide the Facility Engineering Officer, two (2) copies of actual reports for evaluation.

The COTR shall ensure copies of these reports are entered into the System's official acquisition documents.

The Facilities Chief Engineer shall ensure copies of these reports are entered into the System's official technical as-installed documents.

B. Work Not Included: Maintenance and repair service shall not include the performance of any work due to improper use, accidents, other vendor, contractor, owner tampering or negligence, for which the Contractor is not directly responsible and does not control. The Contractor shall immediately notify the COTR in writing upon the discovery of these incidents. The COTR will investigate all reported incidents and render findings concerning any Contractor's responsibility.

- - - E N D - - -

THIS PAGE INTENTIONALLY LEFT BLANK

SECTION 27 15 00
COMMUNICATIONS HORIZONTAL CABLING

PART 1 - GENERAL

1.1 DESCRIPTION

This Section specifies the furnishing, installing, certification, testing, and guaranty of a complete and operating Voice and Digital Cable Distribution System (here-in-after referred to as "*the System*"), and associated equipment and hardware to be installed in the VA or CLC Building here-in-after referred to as "*the Facility*". The System shall include, but not be limited to: equipment cabinets, interface enclosures, and relay racks; necessary combiners, traps, and filters; and necessary passive devices such as: splitters, couplers, cable "patch", "punch down", and cross-connector blocks or devices, voice and data distribution sub-systems, and associated hardware. The System shall additionally include, but not be limited to: telecommunication closets (TC); telecommunications outlets (TCO) and copper distribution cables, connectors, "patch" cables, and/or "break out" devices.

The System shall be delivered free of engineering, manufacturing, installation, and functional defects. It shall be designed, engineered and installed for ease of operation, maintenance, and testing.

The term "provide", as used herein, shall be defined as: designed, engineered, furnished, installed, certified, and tested, by the Contractor.

The Voice and Digital and Analog Telecommunication Distribution Cable Equipment and System provides the media which voice and data information travels over and connects to the Telephone System which is defined as an Emergency Critical Care Communication System by the National Fire Protection Association (NFPA). Therefore, since the System connects to or extends the telephone system, the System's installation and operation shall adhere to all appropriate National, Government, and/or Local Life Safety and/or Support Codes, which ever are the more stringent for this Facility. At a minimum, the System shall be installed according to NFPA, Section 70, National Electrical Code (NEC), Article 517 and Chapter 7; NFPA, Section 99, Health Care Facilities, Chapter 3-4; NFPA, Section 101, Life Safety Code, Chapters 7, 12, and/or 13; Joint Commission on Accreditation of Health Care Organization (JCAHCO), Manual for Health Care Facilities, all necessary Life Safety and/or Support guidelines; this specification; and the

original equipment manufacturer's (OEM) suggested installation design, recommendations, and instructions. The OEM and Contractor shall ensure that all management, sales, engineering, and installation personnel have read and understand the requirements of this specification before the System is designed, engineered, delivered, and provided.

The VA Project Manager (PM) and/or if delegated, Resident Engineer (RE) are the approving authorities for all contractual and mechanical changes to the System. The Contractor is cautioned to obtain in writing, all approvals for system changes relating to the published contract specifications and drawings, from the PM and/or the RE before proceeding with the change.

System Performance:

1. At a minimum, the System shall be able to support the following voice and data, analog RF and operations for Category 6 Certified Telecommunication Service:
 - a. Provide the following interchange (or interface) capabilities:
 - Basic Rate (BRI).
 - Primary Rate (PRI).
 - b. ISDN
 - 1) Narrow Band BRI:
 - B Channel: 64 kilo-Bits per second (Kb/s), minimum.
 - D Channel: 16 kBps, minimum.
 - H Channel: 384 kBps, minimum.
 - 2) Narrow Band PRI:
 - B Channel: 64 kBps, minimum.
 - D Channel: 64 kBps, minimum.
 - H Channel: 1,920 kBps, minimum.
 - 3) Wide (or Broad) Band: All channels: 140 mega(m)-Bps, minimum, capable to 565 mBps at "T" reference.
 - c. ATM operation and interface: ATM 155 Mb/s
 - d. Frame Relay: All stated compliance's.
 - e. Integrated Data Communications Utility (IDCU) operation and interface.
 - f. Government Open Systems Interconnection Profile (GOSSIP) compliant.
 - g. Fiberoptic Distributed Data Interface (FDDI): A minimum 100 mBps to a maximum of 1.8 giga(g)-Bps data bit stream speed (shall be Synchronous Optical Network [SONET] compliant).

h. System Sensitivity: Satisfactory service shall be provided for at least 3,000 feet for all voice and data and analog RF locations. 2. At a minimum the System shall support the following operating parameters:

a. EPBX connection:

System speed: 1.0 gBps per second, minimum.

Impedance: 600 Ohms.

Cross Modulation: -60 deci-Bel (dB).

Hum Modulation: -55 dB.

System data error: 10 to the -10 Bps, minimum.

Loss: Measured at the frame output with reference Zero (0) deciBel measured (dBm) at 1,000 Hertz (Hz) applied to the frame input.

Trunk to station: 1.5 dB, maximum.

Station to station: 3.0 dB, maximum.

Internal switch crosstalk: -60 dB when a signal of + 10 deciBel measured (dBm), 500-2,500 Hz range is applied to the primary path.

Idle channel noise: 25 dBm "C" or 3.0 dBm "O" above reference (terminated) ground noise, whichever is greater.

Traffic Grade of Service for Voice and Data:

A minimum grade of service of P-01 with an average traffic load of 7.0 CCS per station per hour and a traffic overload in the data circuits will not interfere with, or degrade, the voice service.

Average CCS per voice station: The average CCS capacity per voice station shall be maintained at 7.0 CCS when the EPBX is expanded up to the projected maximum growth as stated herein.

b. Telecommunications Outlet (TCO):

1) Voice:

Isolation (outlet-outlet): 24 dB.

Impedance: 600 Ohms, balanced (BAL).

Signal Level: 0 deciBel per mili-Volt (dBmV) + 0.1 dBmV.

System speed: 100 mBps, minimum.

System data error: 10 to the -6 Bps, minimum.

2) Data:

a) Isolation (outlet-outlet): 24 dB.

Impedance: 600 Ohms, BAL.

Signal Level: 0 dBmV + 0.1 dBmV.

System speed: 120 mBps, minimum.

System data error: 10 to the -8 Bps, minimum.

3) Fiber optic:

Isolation (outlet-outlet): 36 dB.

Signal Level: 0 dBmV + 0.1 dBmV.

System speed: 540 mBps, minimum.

System data error: 10 to the -6 bps, minimum.

4) Analog RF Service:

Broadcast or "off air" RF (or television) analog service is considered to be at RF (below 900 MHz in frequency bandwidth). Usually a RF television circuits require a single coaxial cable plant from the headend to each TC location.

Isolation (outlet-outlet): 14 dB.

Impedance: 75 Ohms, Unbalanced (UNBAL).

Signal Level: 10 dBmV + 5.0 dBmV.

Bandwidth: 6.0 MHz per channel, fully loaded.

5) Closed Circuit Video Service: The following minimum operating parameters shall be capable over each installed analog video circuit:

1.2 RELATED WORK

- A. Specification Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Specification Section 27 05 11, REQUIREMENTS FOR COMMUNICATIONS INSTALLATIONS.
- C. Specification Section 27 05 33, RACEWAYS AND BOXES FOR COMMUNICATIONS SYSTEMS.
- D. Specification Section 27 10 00, STRUCTURED CABLING.
- E. Specification Section 26 27 26, WIRING DEVICES.
- F. Specification Section 27 05 26, GROUNDING AND BONDING FOR COMMUNICATIONS SYSTEMS.
- G. Specification Section 27 41 31, MASTER ANTENNA TV EQUIPMENT AND SYSTEMS.

1.3 APPLICABLE PUBLICATIONS

- A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in text by basic designation only. Except for a specific date given the issue in effect (including amendments, addenda, revisions, supplements, and errata) on

the date the system's submittal is technically approved by VA, shall be enforced.

National Fire Protection Association (NFPA):

70	NATIONAL ELECTRICAL CODE (NEC)
75	Protection of Electronic Computer/Data Processing Equipment
77	Recommended Practice on Static Electricity
	Standard for Health Care Facilities
101	Life Safety Code
1221	Emergency Services Communication Systems

Underwriters Laboratories, Inc. (UL):

65	Wired Cabinets
96	Lightning Protection Components
96A	INSTALLATION REQUIREMENTS FOR LIGHTNING PROTECTION SYSTEMS
467	Grounding and Bonding Equipment
497/497A/497B	PROTECTORS FOR PAIRED CONDUCTORS/ COMMUNICATIONS CIRCUITS/DATA COMMUNICATIONS AND FIRE ALARM CIRCUITS
884	Underfloor Raceways and Fittings

ANSI/EIA/TIA Publications:

568C	Commercial Building Telecommunications Wiring Standard
569B	Commercial Building Standard for Telecommunications Pathways and Spaces
606A	ADMINISTRATION STANDARD FOR THE TELECOMMUNICATIONS INFRASTRUCTURE OF COMMERCIAL BUILDINGS
607A	Grounding and Bonding Requirements for Telecommunications in Commercial Buildings
758B	Customer Owned Outside Plant Telecommunications Cabling Standard

Lucent Technologies: Document 900-200-318 "Outside Plant Engineering Handbook".

International Telecommunication Union - Telecommunication Standardization Sector (ITU-T).

Federal Information Processing Standards (FIPS) Publications.

Federal Communications Commission (FCC) Publications: Standards for telephone equipment and systems.

United States Air Force: Technical Order 33K-1-100 Test Measurement and Diagnostic Equipment (TMDE) Interval Reference Guide.

Joint Commission on Accreditation of Health Care Organization (JCAHO): Comprehensive Accreditation Manual for Hospitals.

National and/or Government Life Safety Code(s): The more stringent of each listed code. **1.4 QUALITY ASSURANCE**

ASSURANCE

The authorized representative of the OEM, shall be responsible for the design, satisfactory total operation of the System, and its certification.

The OEM shall meet the minimum requirements identified in Paragraph 2.1.A. Additionally, the Contractor shall have had experience with three or more installations of systems of comparable size and complexity with regards to coordinating, engineering, testing, certifying, supervising, training, and documentation. Identification of these installations shall be provided as a part of the submittal as identified in Paragraph 1.5.

The System Contractor shall submit certified documentation that they have been an authorized distributor and service organization for the OEM for a minimum of three (3) years. The System Contractor shall be authorized by the OEM to certify and warranty the installed equipment. In addition, the OEM and System Contractor shall accept complete responsibility for the design, installation, certification, operation, and physical support for the System. This documentation, along with the System Contractor and OEM certification must be provided in writing as part of the Contractor's Technical Submittal.

All equipment, cabling, terminating hardware, TCOs, and patch cords shall be sourced from the certifying OEM or at the OEM's direction, and support the System design, the OEM's quality control and validity of the OEM's warranty.

The Contractor's Telecommunications Technicians assigned to the System shall be fully trained, qualified, and certified by the OEM on the engineering, installation, and testing of the System. The Contractor shall provide formal written evidence of current OEM certification(s) for the installer(s) as a part of the submittal or to the RE before being allowed to commence work on the System.

1.5 SUBMITTALS

- A. Provide submittals in accordance with Specification Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, and SAMPLES. The COTR shall retain one copy for review and approval.

If the submittal is approved the RE shall retain one copy for Official Records and return three (3) copies to the Contractor.

If the submittal is disapproved, three (3) copies will be returned to the Contractor with a written explanation attached that indicates the areas the submittal deviated from the System specifications. The RE shall retain one copy for Official Records.

- B. Documents: The submittal shall be separated into sections for each subsystem and shall contain the following:

1. Title page to include:

VA Medical Center.

Contractor's name, address, and telephone (including FAX) numbers.

Date of Submittal.

VA Project No.

2. Narrative Description of the system.
3. A List of the equipment to be furnished. The quantity, make, and model number of each item is required. Select the required equipment items quantities that will satisfy the needs of the system and edit between the // - //. Delete equipment items that are not required add additional items required, and renumber section as per system design. The following is the minimum equipment required by the system:

QUANTITY	UNIT
As required	Cabinet Assembly(s)
As required	Environmental Cabinet
As required	Equipment (Radio Relay) Rack
As required	Cross Connection (CCS) Systems
As required	Audio Alarm Panel
As required	TROUBLE ANNUNCIATOR PANEL
As required	Wire Management System/Equipment
As required	Telecommunications Outlets (TCO)
As Required	Distribution Cables

As required	TCO Connection Cables
As required	System Connectors
As required	Terminators
As required	Distribution Frames
As required	Telecommunications Closets (TC)
As required	Environmental Requirements
1 ea.	Installation Kit
As-required	Separate List Containing Each Equipment Spare(s)

Pictorial layouts of each MTC, IMTC, and RTCs; MCCS, IMCCS, VCCS, and HCCS termination cabinet(s), each distribution cabinet layout drawing, and TCO as each is expected to be installed and configured. Equipment technical literature detailing the electrical and technical characteristics of each item of equipment to be furnished. Engineering drawings of the System, showing calculated signal levels at the EPBX output, each input and output distribution point, proposed TCO values, and signal level at each TCO multipin, and coaxial cable jack.

List of test equipment as per paragraph 1.5.D. below.

Letter certifying that the Contractor understands the requirements of the SAMPLES Paragraph 1.5.E.

Letter certifying that the Contractor understands the requirements of Section 3.2 concerning acceptance tests.

C. Test Equipment List:

The Contractor is responsible for furnishing all test equipment required to test the system in accordance with the parameters specified. Unless otherwise stated, the test equipment shall not be considered part of the system. The Contractor shall furnish test equipment of accuracy better than the parameters to be tested.

The test equipment furnished by the Contractor shall have a calibration tag of an acceptable calibration service dated not more than 12 months prior to the test. As part of the submittal, a test equipment list shall be furnished that includes the make and model number of the following type of equipment as a minimum:

Spectrum Analyzer.

Signal Level Meter.

Volt-Ohm Meter.

Time Domain Reflectometer (TDR) with strip chart recorder (Data and Optical Measuring).

Bit Error Test Set (BERT).

Camera with a minimum of 60 pictures to that will develop immediately to include appropriate test equipment adapters. A video camera in VHS format is an acceptable alternate.

Video Waveform Monitor.

Video Vector Scope.

Color Video Monitor with audio capability.

100 MHz Oscilloscope with video adapters.

D. Samples: A sample of each of the following items shall be furnished to the RE for approval prior to installation.

1. TCO Wall Outlet Box 4" x 4"x 2.5" with:
 - One each telephone (or voice) rj45 jack installed.
 - Two each multi pin data rj45 jacks installed.
 - Cover Plate installed.
 - RF (F)/video. 1, F connector installed.
2. Data CCS patch panel, punch block or connection device with RJ45 connectors installed.
3. Telephone CCS system with IDC and/or RJ45 connectors and cable terminal equipment installed.
4. 610 mm (2 ft.) section of each copper cable to be used with cable sweep tags as specified in paragraph 2.4.H and connectors installed.
5. 610 mm (2 ft.) section of each analog RF, video coaxial and audio cable to be used with cable sweep tags as specified in paragraph 2.4.H and connectors installed.
6. Analog video CCS patch panel or breakout box with cable management equipment and "F" connectors installed.
7. Analog RF patch panel or breakout box with cable management equipment and "F" connectors installed.

E. Certifications:

Submit written certification from the OEM indicating that the proposed supervisor of the installation and the proposed provider of the contract maintenance are authorized representatives of the OEM. Include the individual's exact name and address and OEM credentials in the certification.

Submit written certification from the OEM that the wiring and connection diagrams meet National and/or Government Life Safety

Guidelines, NFPA, NEC, UL, this specification, and JCAHCO requirements and instructions, requirements, recommendations, and guidance set forth by the OEM for the proper performance of the System as described herein. The VA will not approve any submittal without this certification.

3. Preacceptance Certification: This certification shall be made in accordance with the test procedure outlined in paragraph 3.2.B.

F. Equipment Manuals: Fifteen (15) working days prior to the scheduled acceptance test, the Contractor shall deliver four complete sets of commercial operation and maintenance manuals for each item of equipment furnished as part of the System to the RE. The manuals shall detail the theory of operation and shall include narrative descriptions, pictorial illustrations, block and schematic diagrams, and parts list.

G. Record Wiring Diagrams:

Fifteen (15) working days prior to the acceptance test, the Contractor shall deliver four complete sets of the Record Wiring Diagrams of the System to the RE. The diagrams shall show all inputs and outputs of electronic and passive equipment correctly identified according to the markers installed on the interconnecting cables, Equipment and room/area locations.

The Record Wiring Diagrams shall be in hard copy and two compact disk (CD) copies properly formatted to match the Facility's current operating version of Computer Aided Drafting (AutoCAD) system. The RE shall verify and inform the Contractor of the version of AutoCAD being used by the Facility.

H. Surveys Required As A Part Of The Technical Submittal: The Contractor shall provide the following surveys that depict various system features and capacities are required in addition to the on site survey requirements described herein. Each survey shall be in writing and contain the following information (the formats are suggestions and may be used for the initial Technical Submittal survey requirements), as a minimum:

1. Cable Distribution System Design Plan: A design plan for the entire cable distribution systems requirements shall be provided with this document. A specific cable count shall coincide with the total growth items as described herein. It is the Contractor's responsibility to provide the Systems entire cable requirements and

engineer a distribution system requirement plan using the format of the following paragraph(s), at a minimum:

a. UTP (and/or STP) Requirements/Column Explanation:

Column	Explanation
FROM BUILDING	Identifies the building by number, title, or location, and main signal closet or intermediate signal closet cabling is provided from
BUILDING	Identifies the building by number, title, or location cabling is to be provided in
TO BUILDING IMC	Identifies building main terminal signal closet, by room number or location, to which cabling is provided too, in, and from
FLOOR	Identifies the floor by number (i.e. 1st, 2nd, etc.) cabling and TCOs are to be provided
TC ROOM NUMBER	Identifies the floor signal closet room, by room number, which cabling shall be provided
ROOM NUMBER	Identifies the room, by number, from which cabling and TCOs shall be provided
NUMBER OF CABLE PAIR	Identifies the number of cable pair required to be provided on each floor designated OR the number of cable pair (VA Owned) to be retained

b. Analog RF Cabling Requirements/Column Explanation:

Column	Explanation
FLOOR	Identifies the floor by number (i.e. 1st, 2nd, etc.)
TC ROOM NUMBER	Identifies the room, by number, from which cabling shall be installed
TO FLOOR TC	Identifies building, by number or location, to which cabling is installed
NUMBER OF STRANDS	Identifies the number of strands in each run of RF cable
INSTALLED METHOD	Identifies the method of installation in accordance with as designated herein
NOTES	Identifies a note number for a special feature or equipment
BUILDING MTC	Identifies the building by number or title //

c. Analog Video Cabling Requirements/Column Explanation:

Column	Explanation
FROM BUILDING	Identifies building, by number or location, from which cabling is installed
TC ROOM NUMBER	Identifies the room, by number, from which cabling shall be installed
TO BUILDING IMC	Identifies building, by number or location, to which cabling is installed
TC ROOM NUMBER	Identifies the room, by number, to which cabling shall be installed
NUMBER OF STRANDS	Identifies the number of strands in each run of fiber optic cable
INSTALLED METHOD	Identifies the method of installation in accordance with as designated herein
NOTES	Identifies a note number for a special feature or equipment
BUILDING MTC	Identifies the building by number or title

2. Telecommunication Outlets: The Contractor shall clearly and fully indicate this category for each outlet location and compare the total count to the locations identified above as a part of the technical submittal. Additionally, the Contractor shall indicate the total number of spares.

PART 2 - PRODUCTS

2.1 EQUIPMENT AND MATERIALS

A. System Requirements:

1. The System shall provide the following minimum services that are designed in accordance with and supported by an Original Equipment Manufacturer (OEM), and as specified herein. The System shall provide continuous inter and/or intra-Facility voice and data, and analog RF service. The System shall be capacity sized so that loss of connectivity to external telephone systems shall not affect the Facilities operation in specific designated locations. The System shall:
 - a. Be capable of inter-connecting and functioning fully with the existing Local Telephone Exchange (LEC) Network(s), Federal Telephone System (FTS) Inter-city Network(s), Inter-exchange Carriers, Integrated Services Digital Network (ISDN), Electronic Private Branch Exchange (EPBX) switches, asynchronous/synchronous

data terminals and circuits including Automatic Transfer Mode (ATM), Frame Relay, and local area networks (LAN), at a minimum.

Be a voice and data cable distribution system that is based on a physical "Star" Topology. An Analog RF coaxial cable distribution system shall be provided in a "home run" configuration from each associated riser TC to identified locations and as shown on the drawings.

Be compatible with and able to provide direct digital connection to trunk level equipment including, but, not limited to: directly accessing trunk level equipment including the telephone system, audio paging, Industry Standard "T" and/or "DS" carrier services and external protocol converters. Additionally, connections to "T" and/or "DS" access/equipment or Customer Service Units (CSU) that are used in FTS and other trunk applications shall be included in the System design. Provide T-1 access/equipment (or CSU), as required for use, in FTS and other trunk applications by system design if this equipment is not provided by the existing telephone system and/or will be deactivated by the installation of the System. The Contractor shall provide all T-1 equipment necessary to terminate and make operational the quantity of circuits designated. The CSU's shall be connected to the System's emergency battery power supply. The System shall be fully capable of operating in the Industry Standard "DS" protocol and provide that service when required.

2. Cable Systems - Twisted Pair and Fiber optic, and Analog RF

Coaxial a. General:

The Contractor shall be responsible for providing a new system conforming to current and accepted telephone and digital, and analog RF industrial/commercial cable distribution standards. The distribution cable installation shall be fully coordinated with the Facility, the COTR and the Contractor prior to the start of installation.

The Contractor is responsible for complete knowledge of the space and cable pathways (i.e. equipment rooms, TCs, conduits, wireways, etc.) of the Facility. The Contractor shall at a minimum design and install the System using the Pathway Design Handbook H-088C3, TIA/EIA Telecommunications Building Wiring Standards, and Facility Chief of Information Resource

Management's (IRM) instructions, as approved in writing by the PM and/or RE.

The System cables shall be fully protected by cable duct, trays, wireways, conduit (rigid, thin wall, or flex), and when specifically approved, flexible innerduct. It is the responsibility of the Contractor to confirm all contract drawings and the Facility's physical layout to determine the necessary cable protective devices to be provided. If flexible innerduct is used, it shall be installed in the same manner as conduit.

Cable provided in the system (i.e. backbone, outside plant, inside plant, and station cabling) shall conform to accepted industry and OEM standards with regards to size, color code, and insulation. The pair twists of any pair shall not be exactly the same as any other pair within any unit or sub-unit of cables that are bundled in twenty-five (25) pairs or less. The absence of specifications regarding details shall imply that best general industry practices shall prevail and that first quality material and workmanship shall be provided. Certification Standards, (i.e., EIA, CCITT, FIPPS, and NFPA) shall prevail.

Some areas of this Facility may be considered "plenum". All wire and cable used in support of the installation in those areas (if any) shall be in compliance with national and local codes pertaining to plenum environments. It is the responsibility of the Contractor to review the VA's cable and wire requirements with the RE and the IRM prior to installation to confirm the type of environment present at each location.

The Contractor shall provide outside and inside plant cables that furnishes the number of cable pairs required in accordance with the System requirements described herein. The Contractor shall fully coordinate and obtain approval of the design with the OEM, RE and the IRM prior to installation.

All metallic cable sheaths, etc. shall be grounded by the Contractor (i.e.: risers, underground, station wiring, etc.) as described herein.

If temporary cable and wire pairs are used, they shall be installed so as to not present a pedestrian safety hazard and the Contractor shall be responsible for all work associated with the temporary installation and for their removal when no longer necessary. Temporary cable installations are not required to meet Industry Standards; but, must be reviewed and approved by the RE and the IRM prior to installation.

Conductors shall be cabled to provide protection against induction in voice and data, and analog RF circuits. Crosstalk attenuation within the System shall be in excess of -80 dB throughout the frequency ranges specified.

Measures shall be employed by the Contractor to minimize the radiation of RF noise generated by the System equipment so as not to interfere with audio, video, data, computer main distribution frame (MDF), telephone customer service unit (CSU), and electronic private branch exchange (EPBX) equipment the System may service.

The System's cables shall be labeled on each end and been fully tested and certified in writing by the Contractor to the RE before proof of performance testing can be conducted. The as-installed drawings shall identify each cable as labeled, used cable, and bad cable pairs. Minimum test requirements are for impedance compliance, inductance, capacitance, signal level compliance, opens, shorts, cross talk, noise, and distortion, and split pairs on all cables in the frequency ranges specified. The tests required for data cable must be made to guarantee the operation of this cable at not less than 10 mega (m) Hertz (Hz) full bandwidth, fully channel loaded and a Bit Error Rate of a minimum of 10^{-6} at the maximum rate of speed. All cable installation and test records shall be made available at acceptance testing by the RE or Contractor and thereafter maintained in the Facility's Telephone Switch Room. All changes (used pair, failed pair, etc.) shall be posted in these records as the change occurs.

The Contractor shall coordinate with the LEC to install the telephone entrance cable to the nearest point of entry into the Facility and as shown on the drawings. The Contractor shall coordinate with the RE and the LEC to provide all cable

pairs/circuits from the Facility point of entry to the Telephone Switch Room all telephone, FTS, DHCP, ATM, Frame Relay, data, pay stations, patient phones, and any low voltage circuits as described herein.

The Contractor shall coordinate with the COTR to provide all cable pairs/circuits from the Facility Telephone Switch Room and establish circuits throughout the Facility for all voice, data, computer alarm (except fire alarm), private maintenance line, Radio Paging, PA, DHCP, and any low voltage circuits as described herein.

The Contractor shall provide proper test equipment to guarantee that cable pairs and analog RF coaxial cable meet each OEM's standard transmission requirements, and guarantee the cable will carry data transmissions at the required speeds, frequencies, and fully loaded bandwidth.

The Contractor shall coordinate with the COTR to install baseband analog RF, video, and audio interface cables and circuits from each TC to designated TCO locations and as shown on the drawings. The Contractor shall work with the COTR to establish circuits throughout the Facility and shall provide proper test equipment to guarantee that analog RF, video, and audio cables meet each OEM's standard transmission requirements, and guarantee the cables will carry video and audio transmissions at the required speeds, frequencies, and fully loaded bandwidth.

- b. Telecommunications Closets (TC): In TC's that are served with both a UTP backbone cable and a fiber optic backbone cable, the UTP and STP cable shall be terminated on separate RJ-45, 8-pin connectors with 110A or equivalent type punch down blocks located on the back or front of a 48-port modular patch panel dedicated to data applications. Only the UTP and STP backbone cable pairs, identified as being connected to the fiber optic backbone, shall be extended to the fiber optic interface device. All connecting cables required to extend these cables (i.e. patch cords, twenty-five pair connectors, etc.), to the fiber optic interface device, in the TC's shall also be provided by the Contractor to insure a complete and operational fiber optic distribution system:

- 1) In TC's, which are only served by a UTP and STP backbone cable, the cable shall be terminated on separate modular connecting devices (110A or equivalent) that are dedicated to data applications. In order to provide full service to all data cable pairs as identified in each TC/cabinet including spare capacity noted herein, the size of all vertical (riser) cables and/or outside cables serving these TC's shall be increased as required.
- c. Backbone and Trunk Cables:
- The Contractor shall identify, in the technical submittal, the voice and data (analog RF coaxial cable shall not be provided in main trunk or backbone lines) connecting arrangements required by the LEC for interconnection of the System to the commercial telephone and FTS networks. The Contractor shall provide all required voice and data connecting arrangements.
- The Contractor shall be responsible for compatibility of the proposed TCs (to be compliant with the EPBX and CSU equipment) numbering scheme with the numbering plan for the FTS, DID, local stations, and the North American Numbering Plan. The Contractor shall consult with the VA and the LEC regarding the FTS and North American Numbering plan to be implemented for the Facility to ensure system compatibility.
- All submitted equipment shall meet or exceed standards, rules, and regulations of the Federal Communications Commission (FCC) and shall be capable of operating without outboard or "extra" devices. The Contractor shall identify the FCC registration number of the System equipment, EPBX, and proposed CSU (if known) in the technical submittal.
- d. Horizontal and Station Cable:
- A Four (4) UTP 24 AWG station wiring cable shall be installed from the top TCO jack to the TC and shall be of a type designed to support Category 6 communications (250 mega-Hertz [mHz] or above). At the jack location, terminate all four pair on the RJ-45/11 jack. At the signal closet, all four pair shall be terminated on the modular punch down blocks dedicated to telephone applications.
- A Four (4) UTP 24 AWG (in thermoplastic jacket unless otherwise specified by RE) station wiring cable shall be

installed from each of the two (2) bottom TCO RJ-45 jacks (shall conform to EIA/TIA 568 Standard "T568A" and NFPA) to the TC and shall be of a type designed to support Category 6 communications (250 MHz or above).

Telecommunication Outlets (TCO), Jacks: All TCO's shall have a minimum of three (3) RJ-45 type jacks. The top jack shall be an eight pin RJ-45/11 compatible jack, labeled, and designated for telephone applications only. The bottom two jacks shall be eight pin RJ-45 type unkeyed (sometimes called center keyed) jacks, labeled, and designated for data.

Patient Bedside Prefabricated Units (PBPU): Where PBPU's exist in the Facility, the Contractor shall identify the single gang "box" location on the PBPU designated for installation of the telephone jack. This location shall here-in-after be identified as the PBTCO. The Contractor shall be responsible for obtaining written approval and specific instructions from the PBPU OEM regarding the necessary disassembly and reassembly of each PBPU to the extent necessary to pull wire from above the ceiling junction box to the PBPU box reserved for the PBTCO. A Contractor provided stainless steel cover plate approved for use by the PBPU OEM and Facility IRM Chief shall finish out the jack installation. Under no circumstances shall the Contractor proceed with the PBPU installations without the written approval of the PBPU OEM and the specific instructions regarding the attachment to or modifying of the PBPU. The RE shall be available to assist the Contractor in obtaining these approvals and instructions in a timely manner as related to the project's time constraints. It is the responsibility of the Contractor to maintain the UL integrity of each PBPU. If the Contractor violates that integrity, it shall be the responsibility of the Contractor to obtain on site UL re-certification of the violated PBPU at the direction of the RE and at the Contractor's expense.

Fiber Optics:

- 1) A complete fiber optic cable distribution system shall be provided as a part of the System. The Contractor shall provide a fiber optic cable that meets the minimum bandwidth requirements for FDDI, ATM, and Frame Relay services. This fiber optic cable shall be a 50/125 micron multi-mode,

containing a minimum of 12 strands of fiber, unless otherwise specified, and shall not exceed a distance of 2,000 Meters (M), or 6,560 feet (ft.) in a single run. Loose tube cable, which separates the individual fibers from the environment, shall be installed for all outdoor runs or for any area which includes an outdoor run. Tight buffered fiber cable shall be used for indoor runs. The multimode fibers shall be terminated and secured at both ends in "LC" type female stainless steel connectors installed in an appropriate patch or breakout panel with a cable management system. A 3 m (10 ft.) cable loop (minimum) shall be provided at each end to allow for future movement.

In addition, a 12 strand (minimum), 8.3 mm single mode fiber optic cable shall be provided. Single mode fibers shall be terminated and secured at both ends with "LC" type female stainless steel connectors installed in an appropriate patch or breakout panel. The panel shall be provided with a cable management system. A 610 mm (2 ft.) cable loop (minimum) shall be provided at each end to allow for future movement.

The fiber optic backbone shall use a conventional hierarchical "star" design where each TC is wired to the primary hub (main cross-connect system) or a secondary hub (intermediate cross-connect system) and then to the primary hub. There shall be no more than two hierarchical levels of cross-connects in the backbone wiring. Each primary hub shall be connected and terminated to a CCS in the Telephone Switch Room.

Additionally, a parallel separate fiber optic interconnection shall be provided between the Telephone Switch Room CCS and the MDF in the Main Computer Room.

In the TC's, Telephone Switch Room, and Main Computer Room, all fiber optic cables shall be installed in a CCS and/or MDF rack mounted fiber optic cable distribution component/splice case (Contractor provided and installed rack), patch, or breakout panel in accordance with industry standards. Female "LC" connectors shall be provided and installed on the appropriate panel for termination of each strand.

The Contractor shall test each fiber optic strand. Cable transmission performance specifications shall be in accordance

with EIA/TIA standards. Attenuation shall be measured in accordance with EIA fiber optic test procedures EIA/TIA-455-46, -61, or -53 and NFPA. Information transmission capacity shall be measured in accordance with EIA/TIA-455-51 or -30 and NFPA. The written results shall be provided to the RE for review and approval.

3. Specific Subsystem Requirements: The System shall consist, as a minimum, of the following independent sub-systems to comprise a complete and functional voice and digital and analog RF telecommunications cabling system: "Main" (MTC), TC's; "backbone" cabling (BC) system; "horizontal" (or "lateral") sub-trunk cabling system, vertical and horizontal cross-connection (VCC and HCC respectively) cabling systems, and TCO's with a minimum of three (3) RJ-45 jacks for the appropriate telephone, Data connections, and additional jacks, connectors, drop and patch cords, terminators, and adapters provided.

- a. Telecommunication Closet (TC):

There shall be a minimum of one TC for the MTC, each building IMTC, and each RTC per building floor location. However, in large building(s), where the horizontal distance to the farthest voice and digital work area may exceed 90 Meters (M) (or 295 feet [ft]), additional TC's shall be provided as described herein. The maximum DC resistance per cable pair shall be no more than 28.6 Ohms per 305 M (1,000 feet). Each TC shall be centrally located to cover the maximum amount of local floor space. The TC's house in cabinets or enclosures, on relay racks, and/or on backboards, various telecommunication data equipment, controllers, multiplexers, bridges, routers, LAN hub(s), telephone cross-connecting, active and passive equipment.

Additionally, the TC's may house fire alarm, nurses call, code one (or blue), video, public address, radio entertainment, intercom, and radio paging equipment. Regardless of the method of installation, mounting, termination, or cross-connecting used, all backbone, vertical, and horizontal copper and fiber optic and analog RF coaxial cables shall be terminated on appropriate cross-connection systems (CCS) containing patch panel(s), punch blocks, and/or breakout devices provided in

enclosures and tested as described herein. A cable and/or wire management system shall be a part of each CCS.

A minimum of three 110-120 VAC active quad outlets shall be provided, each with "U" grounded receptacles at a minimum of one outlet for each front, side and back wall. These outlets shall be separately protected by an AC circuit breaker provided in the designated Government Emergency Critical Care AC power panel, that is connected to the Facilities Emergency AC Power Distribution System. For larger building TC applications, a minimum of one additional quad AC outlet shall be provided for every 800M² (or 8,000 ft²) of useable floor space. Additional outlets shall be equally spaced along the wall.

Climate control shall be provided in each TC 24 hours a day, seven days per week and 52 week per year to prevent failure of electronic components and for mission critical functional applications. The COTR is responsible for informing the Contractor regarding the minimum climate control requirements. In identified hostile TC locations where it has been determined (by the COTR) that proper TC climate or external signal radiation cannot be properly maintained or controlled, the Contractor may, at his/her option, provide a minimum of two individual and properly sized self contained climate controlled equipment cabinet enclosures; one designated for voice, and one designated for data, and one additional cabinet designated for analog RF service, in each TC location identified on the drawings, in lieu of providing additional required TC air handling capability.

b. Cross-connect Systems (CCS):

The CCS shall be selected based on the following criteria:
requires the use of a single tool, has the fewest amount of parts, and requires the least amount of assembly or projected trouble shooting time during the life of the system.

The CCS system used at the MTC, each IMTC, and each TC shall force cross-connect cable slack management through adherence to the OEM's installation methods, provided cable management

systems, and as described herein, so that moves, adds, and changes can be administered easily and cost effectively.

- 3) Copper Cables: The MTC, each IMTC, and TC shall contain a copper CCS sized to support the System TCO's and connections served by each individual TC and as shown on the drawings. The System layout shall allow for a minimum of 50% anticipated growth. Additionally, each CCS must provide maximum flexibility, while maintaining performance, in order to meet system-changing requirements that are likely to occur throughout its useful life.

- 4) Fiber Optic Cables:

The MTC and each TC shall contain a fiber CCS sized to support the System TCO's and connections served by each individual TC and as shown on the drawings. The System layout shall allow for a minimum of 50% anticipated growth.

Each fiber CCS must provide maximum flexibility and cable management while maintaining performance in order to meet changing requirements that are likely to occur throughout the expected life of the system. All fiber optic cable slack shall be stored in protective enclosures.

If it is determined that a fiber optic distribution system is not necessary for the immediate system needs. Each TC shall be provided with fiber optic cable(s) that contain a minimum of 12 strands "dark" multimode fiber and 12 strands "dark" single mode fiber, each fiber properly terminated on its respective female stainless steel connector mounted in an appropriate fiber termination enclosure provided in each TC.

- 5) The Contractor shall not "cross-connect" the copper or fiber optic cabling systems and subsystems even though appropriate "patch" cords are to be provided for each "patch", "punch", or "breakout" panel. In addition, the Contractor shall not provide active electronic distribution or interface equipment as a part of the System.
- 6) Grounding: Proper grounding and bonding shall be provided for each TC and all internal equipment. Reference shall be made to proper codes and standards, such that all grounding systems must comply with all applicable National, Regional, and Local

Building and Electrical codes. The most stringent code of these governing bodies shall apply.

If local grounding codes do not exist for the System location, then at a minimum, a #6 American Wire Gauge (AWG) stranded copper wire, or equivalent copper braid, shall be connected to a separate earth grounding system for each TC (the looping of TC's in a general location is allowed as long as the specifications contained herein are met). Under no circumstance shall the AC neutral be used for this ground. See PART 3 - EXECUTION for specific grounding instructions. Each copper UTP or STP cable that enters a TC from the outside of a building (regardless if the cable is installed underground or aerial) shall be provided with a surge protector and grounded an to earth ground at each cable's entry point in and out of the MTC and each IMTC.

Main Cross-connection Subsystem (MCCS): The MCCS shall be located in the MTC and it shall be the common point of appearance for inter and intra-building copper and fiber optic "backbone" system cables, and connections to the telephone and data cable systems. The MTC usually houses telephone EPBX, public address, radio paging interface, routers, and main hierarchical data LAN concentrating equipment. Additionally, it shall provide a single administration and management point for the entire System.

Voice (or Telephone) Cable Cross-Connection Subsystem:

Due to the usually high number of copper cable termination's required at the MCCS, Insulation Displacement Connection (IDC) hardware shall be used. Termination options shall include the following for a Category 6 Cabling System: IDC termination of cross-connection wire(s), IDC patch cord connector to IDC patch cord connector, and hybrid modular cord to IDC patch cord connector shall be the minimum provided.

Additionally, due to the large or many MCCS (at initial installation and over the life of the System) copper termination points, the CCS that makes the best use of real estate while still following the OEM design and installation guidelines, and meeting the specifications described herein, shall be provided.

For ease of maintenance purposes, all terminations shall be accessible without the need for disassembly of the IDC wafer. IDC wafers shall be removable from their mounts to facilitate testing on either side of the connector. Designation strips or labels shall be removable to allow for inspection of the terminations. The maximum number of terminations on a wall or on a rack frame or panel shall comply with the OEM recommendations and guidelines, and as described herein. A cable management system shall be provided as a part of the IDC.

IDC connectors shall be capable of supporting cable re-terminations without damaging the connector and shall support a minimum of 200 (telephone equipment standard compliant) IDC insertions or withdrawals on either side of the connector panel.

A non-impact termination method using a full-cycle terminating tool having both a tactile and an audible feedback to indicate proper termination is required. For personnel safety and ease of use in day to day administration, high impact installation tools shall not be used.

All system "inputs" from the EPBX, FTS, Local Telephone System, or diverse routed voice distribution systems shall appear on the "left" side of the IDC (110A blocks with RJ45 connections are acceptable alternates to the IDC) of the MCCS.

All system "outputs" from the MCCS to the voice backbone cable distribution system shall appear on the "right" side of the same IDC (or 110A blocks) of the MCCS.

The splitting of pairs within cables between different jacks or connections shall not be allowed. In the case of ISDN and/or ATM and /or Frame Relay applications, terminating resistors shall be provided externally to the patch panel connector or jack.

UTP or STP cross connecting wires shall be provided for each "pair" of connection terminals plus an additional 50% spare. e. Data Cross-Connection Subsystems:

- 1) The MCCS shall be a Main Distribution Terminating (MDT) data unit and shall be provided in the MTC. The MDT shall consist of a "patch" panel(s) provided with modular RJ45 female

connectors for cross-connection of all copper data cable terminations. The panels shall provide for system grounding (where no dielectric cables are used) and be provided with a cable management system.

- 2) Each panel shall conform to EIA dimensions and be suitable for mounting in standard equipment racks, have the RJ45 jacks aligned in two horizontal rows (up to a maximum of 48 jacks per panel), and shall not exceed the OEM's recommendations. Each RJ45 jack shall be of modular design and capable of accepting and functioning with other modular (i.e. RJ11) plugs without damaging the jack. It is not necessary to provide a jack for unused positions that are not part of the 50% expansion requirement.

All data system inputs from the server(s), data LAN, bridge, or interface distribution systems shall appear on the "top" row of jacks of the appropriate patch panel.

All System outputs or backbone cable connections shall appear on the "bottom" row of jacks of the same patch panel.

The splitting of pairs within cables between different jacks shall not be allowed. In the case of ISDN and/or ATM and/or Frame Relay applications, terminating resistors shall be provided externally to the patch panel connector or jack.

- 3) A patch cord shall be provided for each system "pair" of connection jacks. Each patch cord shall have modular RJ45 connectors provided on each end to match the panel's modular RJ45 female jack's being provided.

f. Fiber optic Cross-Connection Subsystems: The MTC shall be provided with a separate fiber MCCS. Each TC shall be provided with a rack mounted patch or distribution panel that is installed inside a lockable cabinet or "breakout enclosure" that accommodates a minimum of 12 strands multimode fiber and 12 strand single mode fiber (these counts shall not be included the 50% spare requirement). A cable management system shall be provided for each panel.

- 1) The panel(s) shall contain a minimum of 24 female "LC" connectors, be able to accommodate splices and field mountable

connectors and have capacity for additional connectors to be added up to the OEM's maximum standard panel size for this type of use. All patch panel sides, including the front and back, shall be protected by a cabinet or enclosure.

- 2) The panel(s) shall conform to EIA dimensions and be suitable for installation in standard racks, cabinets, and enclosures. The panels shall provide for system grounding (where no dielectric cables are used).
 - 3) The patch panel with the highest OEM approved density of fiber "LC" termination's (maximum of 72 each), while maintaining a high level of manageability, shall be selected. Patch cables, with proper "LC" connectors installed on each end shall be provided for each pair of fiber optic cable "LC" connectors. All System "inputs" from interface equipment or distribution systems shall appear on the "top" row of connectors of the appropriate patch panel. All System "outputs" or backbone cable connections shall appear on the "bottom" row of connectors of the same patch panel.
 - 4) In order to achieve a high level of reliability that approximates that of an OEM connector, field installable connectors shall have an OEM specified physical contact polish. Every fiber cable shall be terminated with the appropriate connector, and tested to ensure compliance to OEM and specifications outlines herein. Where a local fiber optic system connector standard, Industry Standard fiber optic "ST" female connector terminated with a fiber optic cable, shall be used. But, if the fiber optic cable is not used (or "dark"), a "LC" male terminating "cap" shall be provided for each unused "LC" female connector.
- g. Intermediate Cross-connection Subsystems (IMCCS): The MTC and each IMTC shall be provided with an IMCCS that shall be the connection point between the MCCS system and the distribution backbone cable and the IMCCS, that is located in one or more buildings on a campus, where each IMCCS is placed by system design. For a technical explanation of internal equipment and system requirements, refer to the above MTC and MCCS paragraphs.

- h. Distribution Cable Systems / Backbone Cable System (Common to Inter-buildings): The backbone cable system extends from the MCCS to each IMCCS to establish service between buildings on a campus. The media (copper and fiber optic) used in the BC system shall be designed according to the system requirements, OEM standards and guidelines, and as described herein. A multi-pair copper for voice and data, and separate multiple fiber optic backbone system shall be provided as a part of the BC distribution system. All outside cable shall be minimum of STP or UTP, 22 AWG solid conductors, solid PVC insulation, and filled core (flexgel - waterproof Rural Electric Association (REA) LISTED PE 39 CODE) between the outer armor or jacket and inner conductors protective lining.
- The copper cable system shall be configured as a "Star" Topology with separate dedicated cables between the MCCS and each IMCCS.
- UTP and STP copper cables shall consist of thermoplastic insulated conductors formed into binder groups. The groups are to be identified by distinctly colored binders and assembled to form a single compact core covered by a protective sheath. Each cable shall be rated for Category 6 Telecommunications System Service. A minimum of eight pairs per circuit, plus an additional 50% spare for growth shall be provided.
- Where the distance limitations of UTP or STP may be exceeded, multimode (or single mode) fiber optic cable(s) shall be used to augment the voice and/or data backbone cable system(s). The total loss of each fiber shall not exceed 12 decibel (dB) at 850 nano-Meter (nM), 11 dB at 1,300 nM, or 10 dB at 1,500 nM.
- All voice system "inputs" from the MCCS via the BC distribution system shall appear on the "left" side of IDC (minimum 110 blocks) punch terminals of the IMCCS.
- All voice system "outputs" or trunk line connections shall appear on the "right" side of the same IDC (minimum 110 blocks) of the IMCCS.
- All data system "inputs" from the MCCS via the BC distribution system shall appear on the "top" row of jacks of the appropriate patch panel of the IMCCS.

All data system "outputs" or trunk line connections shall appear on the "bottom" row of jacks in the same patch panel of the IMCCS.

The splitting of pairs within cables between different jacks shall not be allowed. In the case of ISDN and/or ATM and /or Frame Relay applications, terminating resistors shall be provided externally to the patch panel connector or jack.

A patch cord shall be provided for each system "pair" of connection jacks. Each patch cord shall have modular connectors provided on each end to match the panel's modular female jack.

The fiber optic BC system shall be configured as a "Star" Topology with separate dedicated fibers between the MCCS and each IMCCS. The System shall be sized to meet the system requirements plus an expansion capability of 50%. Fiber optic cable(s) having a minimum of 12 strands multimode fiber.

All BC shall be identified with permanent labels at both ends. Labels will indicate system, floor, closet, and zone. The label designations shall match those used for cross-connect terminals and patch panels.

- i. Distribution (Common to Intra-Building) Cabling Systems: The intra-building trunk cabling system provides for connection between the IMCCS and each Riser TC's provided vertical cross-connecting system (VCCS) within a building. The media (copper, fiber optic, and RF coaxial) used in the intra-building backbone cabling system shall be designed according to the system requirements, OEM standards and guidelines, and as described herein. A multi-pair copper for voice and data, and separate multiple fiber optic, and analog RF coaxial trunk system shall be provided as a part of the System.

Category 6 UTP or STP multi-pair trunk cable(s) shall be used in the voice and data trunk-line-cabling systems. A minimum of eight pairs per circuit, plus an additional 50% spare for growth shall be provided.

Where the distance limitations of UTP and/or STP will be exceeded, multimode (or single mode) fiber optic cable shall be used in the voice and/or trunk cabling systems. The total

loss of the fiber trunks shall not exceed 12 dB at 850 nM ,
11 dB at 1,300 nM, or 10 dB at 1,500 nM.

All voice system "outputs" from the IMCCS to the trunk-line
distribution system shall appear on the "right" side of
IDC (minimum 110A blocks) punch terminals of the IMCCS.
All data system "outputs" from the IMCCS to the trunk-line
distribution system shall appear on the "bottom" row of
jacks of the same IDC (minimum 110A blocks) of the IMCCS.
The splitting of pairs within cables between different jacks
shall not be allowed. In the case of ISDN and/or ATM
and/or Frame Relay applications, terminating resistors
shall be provided externally to the patch panel connector
or jack.

A patch cord shall be provided for each system "pair" of
connection jacks. Each patch cord shall have modular
connectors provided on each end to match the panel's
modular female jack.

- 3) The fiber optic trunk line system shall be configured as
a "Star" Topology with separate dedicated fibers between
the IMCCS and each RCS. The System shall be sized to meet
the System requirements with a expansion capability of
50% provided. Separate individual fiber optic cable(s)
with a minimum of 12 strands multimode fiber.
- 4) All trunk lines shall be identified with permanent labels at
both ends. Labels will indicate system, floor, closet, and
zone. The label designations shall match those used for
cross-connects and patch panels.

All System outputs from the IMCCS to the trunk-line
distribution system shall appear on the "bottom" row
of "LC" connectors in the appropriate patch panel.

A patch cord shall be provided for each system "pair" of
connection "LC" connectors. As a minimum, each patch
cord shall have "LC" male connectors provided on each
end to match the panel's female "LC" connector provided.

- 5) An analog RF coaxial cable trunk system shall be provided.
Coaxial cables shall be provided to comprise an individual
circuit as designated and as shown on the drawings. Additional

analog RF coaxial cables shall be provided as system design dictates and as shown on the drawings.

- 6) The analog RF coaxial trunk-line systems shall be connected between each IMCCS "bottom" row of "F" connectors and shall terminate on the VCCS "top" row of "F" connectors on an appropriate patch panel. A minimum of six coaxial cables shall be provided in the riser trunk-line system.
- j. Horizontal Cross-connecting (HCCS) Systems: Each TC shall be provided with a separate HCCS located within the TC. The HCCS shall interconnect and interface the network equipment with the horizontal (or station) sub-trunk line cables. The media (copper, fiber optic and analog RF coaxial) used in the CCS system shall be designed according to the System requirements, OEM standards and guidelines, and as described herein. A multi-pair copper for voice and data, and separate multiple fiber optic and RF coaxial CCS system shall be provided as a part of the System.
- 1) The UTP, STP, and fiber optic and RF coaxial trunk-line cabling systems are that connected between the trunk-lines and Riser VCCS, shall be terminated:
 - On the "left" or "top" IDC (or 110A blocks) for each UTP or STP voice cable.
 - On the "top" row of RJ45 jacks on the appropriate patch panel for each UTP or STP data cable.
 - On the "top" row of "ST" connectors on the appropriate patch panel for each fiber and "F" connectors for each analog RF coaxial cable.
 - 2) The UTP, STP, and fiber optic and analog RF coaxial sub-trunk (lateral) floor distribution cabling systems that are connected between each RTC and each TCO or secondary system distribution or connection point, shall terminate on an appropriate HCCS, at the:
 - On the "right" IDC (or 110A block) used as the VCCS input for each UTP or STP voice cable.
 - On the "bottom row of RJ45 jacks on the appropriate patch panel used as the VCCS input for each UTP or STP data cable.

On the "bottom" row of "LC" connectors on the appropriate patch panel used as the VCCS input for each fiber and "F" connectors for each analog RF coaxial cable.

The technical requirements of the "patch", "terminating", or "breakout" panels and cable management assemblies for voice, data and fiber optic and RF coaxial cables shall be as described in the above MCCS, IMCCS, and TC technical paragraphs.

The Contractor shall not "cross-connect" the VCCS or HCCS cabling systems even though appropriate patch cords are provided for each "patch", "punch", or "breakout" panel. Also, the Contractor shall not provide active interface or distribution electronic equipment as a part of the System.

The analog RF coaxial cabling systems shall be connected between each IMCS and RTC shall terminate on the VCCS on the "top" row of "F" connectors on an appropriate patch panel. Additionally, each horizontal distribution analog RF coaxial cable shall terminate on the HCCS on the "bottom" row of "F" connectors of the same panel.

The analog RF terminating panel(s) shall be the "patch" type. Each panel shall be the 19" EIA rack dimensions and provided with a minimum of 12 double female "F" connector rows. Each patch panel shall be provided with the expansion capability of a maximum of 24 double row "F" slots that can be field activated.

Each analog RF "patch" panel shall be provided inside a lockable cabinet or enclosure. Stacking of the "patch" panels is permitted as long as installation guidelines are met. k. Horizontal (or Station) Cabling (HC): The HC distribution cabling systems connects the distribution field of the voice and data HCCS, in a "Star" Topology, to each TCO or connector and as shown on the drawings via the sub-trunk system.

Horizontal cables shall consist of insulated, UTP or STP conductors that are rated for Category 6 telecommunications service for voice and data systems.

The number of UTP or STP distribution pairs dedicated to each floor from the HC shall be sufficient to accommodate all the

horizontal voice and data circuits served by the distribution cable to each TCO.

A minimum of four pairs for voice shall be connected to the "right" side of the IDC (or 110A block) that the VCCS "input" connections appear in the RTC.

A minimum of two separate sets of four pairs each for data shall be connected to the "bottom" row of RJ45 jacks that the VCCS "input" connections appear in the RTC.

The horizontal cable length to the farthest system outlet shall be limited to a maximum of 90M (or 295 ft). These maximum lengths must be derated, adjusted and reduced to include cross-connection and distribution system losses. Additional TC(s) shall be provided on large floor areas of buildings to limit the horizontal distribution to a maximum of 90M (or 295 ft).

The splitting of pairs within a cable between different jacks shall not be permitted.

The installation of the HC shall conform to appropriate OEM recommendations and standards outlined herein. This requirement will insure adequate protection for Electro-Magnetic Interference (EMI) sources.

A system design where "looping" the HC distribution cables from room to room shall not be permitted.

The analog RF coaxial cables dedicated from the "bottom" row of "F" connectors of the appropriate VCCS patch panel where the "input" connections were made, to each floor TCO shall provided in the "home run" configuration and be sufficient to accommodate all the TCO's served by the HC distribution cable system minimum of one analog RF coaxial cable shall be provided for each TCO circuit and as shown on the drawings).

1. System Telecommunication Outlets (TCO): The System shall be capable of receiving the specified telephone (or voice) and data signals acquired from the LEC, FTS contracted carrier and computer system, and one each analog RF cable, and one each fiber optic single mode and multimode cables and shall process and distribute them to the designated TCO's and as shown on the drawings. At a minimum, one TCO shall be provided on each room wall, associated with an active 120 VAC shall be provided and as

shown on the drawings. The only exception to the general rule, of one outlet per wall, shall be those "special" locations (e.g., surgical suites, radiology MRI rooms, labs, patient bed rooms, warehouse, loading docks, storage rooms, etc.) where there is usually only one TCO provided as designated on the drawings.

Each TCO shall consist of three multipin modular RJ45 jacks, one designated for telephone and two for data service. Each TCO with appropriate jacks installed shall be provided by the Contractor in each designated location and as shown on the drawings.

The Contractor shall connect each telephone multipin modular RJ45 jack to a separate "right side as you look at it" telephone HC distribution system HCCS "punch down" 110A block or approved IDC terminating device in each associated RTC. The modular RJ45 jack shall be able to accept and operate with smaller modular RJ11 plugs while providing proper connection and not damaging the modular jack. The OEM shall warrant all modular RJ45/11 jacks in such a manner to be usable for modular RJ11 plugs.

The Contractor shall connect each TCO data multipin modular RJ45 jack to a separate lower row jack on the HCCS "patch panel" in each associated RTC. The Contractor is not to "cross-connect" HCCS data distribution cables or provides active electronic data distribution equipment as a part of the System.

A non-impact termination method, using either a stuffer cap with installation tool or full-cycle terminating tool having both tactile and audible feedback to indicate proper termination shall be used. High impact installation tools shall not be used.

Each terminated conductor end shall be properly trimmed to assure a minimum clearance of 6.35 mm (0.250 in) clearance between the conductors of adjacent modules.

The multipin RJ45 jack shall be modular in construction that will accept and operate with a modular UTP and STP RJ45 connector and its pin assignments.

The Contractor shall connect each analog RF cable to a female "F" connector provided on each TCO and as shown on the

drawings and to each bottom row of "F" connectors on the HCCS patch panel(s) serving the area. The Contractor is not to "interconnect" HCCS analog RF distribution cables OR provides active analog RF distribution equipment as a part of the System.

B. System Performance:

1. At a minimum, the System shall be able to support the following voice and data and analog RF operations for Category 6 Certified Telecommunication Service:
 - a. Provide the following interchange (or interface) capabilities:
 - Basic Rate (BRI).
 - Primary Rate (PRI).
 - b. ISDN
 - 1) Narrow Band BRI.
 - B Channel: 64 kilo-Bits per second (kBps), minimum.
 - D Channel: 16 kBps, minimum.
 - H Channel: 384 kBps, minimum.
 - 2) Narrow Band PRI:
 - B Channel: 64 kBps, minimum.
 - D Channel: 64 kBps, minimum.
 - H Channel: 1,920 kBps, minimum.
 - 3) Wide (or Broad) Band:
 - a) All channels: 140 mega(m)-Bps, minimum, capable to 565 mBps at "T" reference.
 - c. ATM operation and interface: ATM 155 mBps.
 - d. Frame Relay: All stated compliance's.
 - e. Integrated Data Communications Utility (IDCU) operation and interface
 - f. Government Open Systems Interconnection Profile (GOSSIP) compliant.
 - g. Fiberoptic Distributed Data Interface (FDDI): A minimum 100 mBps to a maximum of 1.8 giga(g)-Bps data bit stream speed measured at (shall be Synchronous Optical Network [Sonet] compliant).
 - h. System Sensitivity: Satisfactory service shall be provided for at least 3,000 feet for all voice and data and analog RF locations.
2. At a minimum the System shall support the following operating parameters:
 - a. EPBX connection:

System speed: 1.0 gBps per second, minimum.

Impedance: 600 Ohms.

Cross Modulation: -60 deci-Bel (dB).

Hum Modulation: -55 Db.

System data error: 10 to the -10 Bps, minimum loss measured at the frame output with reference Zero (0) deciBel measured (dBm) at 1,000 Hertz (Hz) applied to the frame input.

Trunk to station: 1.5 dB, maximum.

Station to station: 3.0 dB, maximum.

Internal switch crosstalk: -60 dB when a signal of + 10 deciBel measured (dBm), 500-2,500 Hz range is applied to the primary path.

Idle channel noise: 25 dBm "C" or 3.0 dBm "O" above reference (terminated) ground noise, whichever is greater.

Traffic Grade of Service for Voice and Data:

A minimum grade of service of P-01 with an average traffic load of 7.0 CCS per station per hour and a traffic overload in the data circuits will not interfere with, or degrade, the voice service.

Average CCS per voice station: The average CCS capacity per voice station shall be maintained at 7.0 CCS when the EPBX is expanded up to the projected maximum growth as stated herein.

b. Telecommunications Outlet (TCO):

1) Voice:

Isolation (outlet-outlet): 24 dB.

Impedance: 600 Ohms, balanced (BAL).

Signal Level: 0 deciBel per mili-Volt (dBmV) + 0.1 dBmV.

System speed: 1000 Mb/s, minimum.

System data error: 10 to the -6 Bps, minimum.

2) Data:

Isolation (outlet-outlet): 24 dB.

Impedance: 600 Ohms, BAL.

Signal Level: 0 dBmV + 0.1 dBmV.

System speed: 1000 Mb/s, minimum.

System data error: 10 to the -8 Bps, minimum.

4) Analog RF Service: Broadcast or "off air" RF (or television) analog service is considered to be at RF (below 900 mHz in

frequency bandwidth). Usually a RF television circuits require a single coaxial cable plant from the headend to each TC location.

Isolation (outlet-outlet): 14 dB.

Impedance: 75 Ohms, Unbalanced (UNBAL).

Signal Level: 10 dBmV + 5.0 dBmV.

Bandwidth: 6.0 MHz per channel, fully loaded

- 5) Closed Circuit Video Service: Analog video service is considered to be at baseband (below 100 MHz in frequency bandwidth). The following minimum operating parameters shall be capable over each installed analog video circuit:

Impedance: 75 Ohm, unbalanced.

Output Level: 1.0 V peak to peak (P-P), for 87.5% depth of Modulation (Mod).

Diff Gain: ± 1 dB at 87.5% Mod.

Diff Phase: ± 1.5 at 87.5% Mod.

Signal to Noise (S/N) ratio: 44 dB, minimum.

Hum Modulation: -55 dB.

Return Loss: -14 dB (or 1.5 Voltage Standing Wave Ratio [VSWR]), maximum.

Isolation (outlet-outlet): 24 dB, minimum.

Bandwidth: 6.0 MHz per channel, fully loaded, minimum.

C. General:

1. All equipment to be supplied under this specification shall be new and the current model of a standard product of an OEM or record. An OEM of record shall be defined as a company whose main occupation is the manufacture for sale of the items of equipment supplied and which:

Maintains a stock of replacement parts for the item submitted.

Maintains engineering drawings, specifications, and operating manuals for the items submitted.

Has published and distributed descriptive literature and equipment specifications on the items of equipment submitted at least 30 days prior to the Invitation for Bid.

2. Specifications of equipment as set forth in this document are minimum requirements, unless otherwise stated, and shall not be construed as limiting the overall quality, quantity, or performance characteristics of items furnished in the System. When the

Contractor furnishes an item of equipment for which there is a specification contained herein, the item of equipment shall meet or exceed the specification for that item of equipment.

The Contractor shall provide written verification, in writing to the RE at time of installation, that the type of wire/cable being provided is recommended and approved by the OEM. The Contractor is responsible for providing the proper size and type of cable duct and/or conduit and wiring even though the actual installation may be by another subcontractor.

Active electronic component equipment shall consist of solid state components, be rated for continuous duty service, comply with the requirements of FCC standards for telephone equipment, systems, and service.

All passive distribution equipment shall meet or exceed -80 dB radiation shielding specifications.

All interconnecting twisted pair, fiber-optic or coaxial cables shall be terminated on equipment terminal boards, punch blocks, breakout boxes, splice blocks, and unused equipment ports/taps shall be terminated according to the OEM's instructions for telephone cable systems without adapters. The Contractor shall not leave unused or spare twisted pair wire, fiber-optic, or coaxial cable unterminated, unconnected, loose or unsecured.

Color code all distribution wiring to conform to the Telephone Industry standard, EIA/TIA, and this document, which ever is the more stringent. At a minimum, all equipment, cable duct and/or conduit, enclosures, wiring, terminals, and cables shall be clearly and permanently labeled according to and using the provided record drawings, to facilitate installation and maintenance. Reference Specification Section 27 10 00, STRUCTURED CABLING and Section 27 31 00, VOICE COMMUNICATIONS SWITCHING AND ROUTING EQUIPMENT.

Connect the System's primary input AC power to the Facility's Critical Branch of the Emergency AC power distribution system as shown on the plans or if not shown on the plans consult with RE regarding a suitable circuit location prior to bidding.

Plug-in connectors shall be provided to connect all equipment, except coaxial cables and interface points. Coaxial cable distribution points and RF transmission lines shall use coaxial cable connections recommended by the cable OEM and approved by the

System OEM. Base- band cable systems shall utilize barrier terminal screw type connectors, at a minimum. Crimp type connectors installed with a ratchet type installation tool are and acceptable alternate as long as the cable dress, pairs, shielding, grounding, and connections and labeling are provided the same as the barrier terminal strip connectors. Tape of any type, wire nuts, or solder type connections are unacceptable and will not be approved.

All equipment faceplates utilized in the System shall be stainless steel, anodized aluminum, or UL approved cycolac plastic for the areas where provided.

Noise filters and surge protectors shall be provided for each equipment interface cabinet, switch equipment cabinet, control console, local, and remote active equipment locations to ensure protection from input primary AC power surges and noise glitches are not induced into low Voltage data circuits.

Underground warning tape shall be standard, 4-Mil polyethylene 76 mm (3 inch) wide tape detectable type, red with black letters imprinted with "CAUTION BURIED ELECTRIC LINE BELOW", orange with black letters imprinted with "CAUTION BURIED TELEPHONE LINE BELOW" or orange with black letters imprinted with "CAUTION BURIED FIBER OPTIC LINE BELOW", as applicable.

D. Equipment Functional Characteristics:

FUNCTIONS	CHARACTERISTICS
Input Voltage	105 to 130 VAC
POWER LINE FREQUENCY	60 HZ \pm 2.0 HZ
Operating Temperature	0 to 50 degrees ($^{\circ}$) Centigrade (C)
Humidity	80 percent (%) minimum rating

E. Equipment Standards and Testing:

The System has been defined herein as connected to systems identified as Critical Care performing Life Support Functions. Therefore, at a minimum, the system shall conform to all aforementioned National and/or Local Life Safety Codes (which ever are the more stringent), NFPA, NEC, this specification, JCAHCO Life Safety Accreditation requirements, and the OEM recommendations, instructions, and guidelines.

All supplies and materials shall be listed, labeled or certified by UL or a nationally recognized testing laboratory where such

standards have been established for the supplies, materials or equipment. See paragraph minimum requirements Section 27 05 11, REQUIREMENTS FOR COMMUNICATIONS INSTALLATIONS, and the guidelines listed in paragraph 2.J.2.

The provided active and passive equipment required by the System design and approved technical submittal must conform with each UL standard in effect for the equipment, as of the date of the technical submittal (or the date when the RE approved system equipment necessary to be replaced) was technically reviewed and approved by VA. Where a UL standard is in existence for equipment to be used in completion of this contract, the equipment must bear the approved UL seal.

Each item of electronic equipment to be provided under this contract must bear the approved UL seal or the seal of the testing laboratory that warrants the equipment has been tested in accordance with, and conforms to the specified standards.

2.2 DISTRIBUTION EQUIPMENT AND SYSTEMS

A. Telecommunication Outlet (TCO):

The TCO shall consist of one telephone multipin jack and two data multipin jacks mounted in a steel outlet box. A separate 100mm (4in.) x 100mm (4in.) x 63mm (2.5in.) steel outlet box with a labeled stainless steel faceplate will be used. A second 100mm (4in.) x 100mm (4in.) x 63mm (2.5in.) steel outlet box with a labeled faceplate shall be provided as required adjacent to the first box to ensure system connections and expandability requirements are met.

All telephone multipin connections shall be RJ-45/11 compatible female types. All data multipin connections shall be RJ-45 female types. All analog RF, video, connections shall be "F".

The TCO shall be fed from the appropriate CCS located in the respective RTC in a manner to provide a uniform and balanced distribution system.

Interface of the data multipin jacks to appropriate patch panels (or approved "punch down" blocks) in the associated RTC, is the responsibility of the Contractor. The Contractor shall not extend data cables from the RTCs to data terminal equipment or install data terminal equipment.

The wall outlet shall be provided with a stainless steel or approve alternate cover plate to fit the telephone multipin jack, data multi-pin jacks and the outlet box provided (100mm (4in.) x 100mm (4in.) for single and 100mm (4in.) x 200mm (8in.) for dual outlet box applications). For PBPU installations, the cover plate shall be stainless steel.

Interface of the analog RF "F", video to appropriate patch panels in the associated RTC, is the responsibility of the Contractor. The Contractor shall not cross-connect analog cables in the RTCs to analog equipment or install active analog equipment.

B. Distribution Cables: Each cable shall meet or exceed the following specifications for the specific type of cable. Each cable reel shall be sweep tested and certified by the OEM by tags affixed to each reel. The Contractor shall turn over all sweep tags to the RE or PM.

Additionally, the Contractor shall provide a 610 mm (2 ft.) sample of each provided cable, to the RE and receive approval before installation. Cables installed in any outside location (i.e. above ground, under ground in conduit, ducts, pathways, etc.) shall be filled with a waterproofing compound between outside jacket (not immediately touching any provided armor) and inter conductors to seal punctures in the jacket and protect the conductors from moisture.

1. Remote Control:

The remote control cable shall be multi-conductor with stranded (solid is permissible) conductors. The cable shall be able to handle the power and voltage necessary to control specified system equipment from a remote location. The cable shall be UL listed and pass the FR-1 vertical flame test, at a minimum. Each conductor shall be color-coded. Combined multi-conductor and coaxial cables are acceptable for this installation, as long as all system performance standards are met.

Technical Characteristics:

Length	As required, in 1K (3,000 ft.) reels minimum
Connectors	As required by system design
Size	18 AWG, minimum, Outside 20 AWG, minimum, Inside
Color coding	Required, EIA industry standard
Bend radius	10X the cable outside diameter

Impedance	As required
Shield coverage	As required by OEM specification
Attenuation	
Frequency in mHz	dB per 305 M (1,000ft.), maximum
0.7	5.2
1.0	6.5
4.0	14.0
8.0	19.0
16.0	26.0
20.0	29.0
25.0	33.0
31.0	36.0
50.0	52.0

2. Telephone:

The System cable shall be provided by the Contractor to meet the minimum system requirements of Category Six service. The cable shall interconnect each part of the system. The cable shall be completely survivable in areas where it is installed.

Technical Characteristics:

Length	As required, in 1K (3,000 ft.) reels minimum
Cable	Voice grade category six
Connectors	As required by system design
Size	22 AWG, minimum, Outside 24 AWG, minimum, Inside
Color coding	Required, telephone industry standard
Bend radius	10X the cable outside diameter
Impedance	120 Ohms + 15%, BAL
Shield coverage	As required by OEM specification
Attenuation	
Frequency in mHz	dB per 305 M (1,000ft.), maximum
0.7	5.2
1.0	6.5
4.0	14.0
8.0	19.0
16.0	26.0

20.0	29.0
25.0	33.0
31.0	36.0
62.0	52.0
100.0	68.0

3. Data Multi-Conductor:

The cable shall be multi-conductor, shielded or unshielded cable with stranded conductors. The cable shall be able to handle the power and voltage used over the distance required. It shall meet Category 6 service at a minimum.

Technical Characteristics:

Wire size	22 AWG, minimum
Working shield	350 V
Bend radius	10X the cable outside diameter
Impedance	100 Ohms + 15%, BAL
Bandwidth	100 MHz, minimum
DC RESISTANCE	10.0 Ohms/100M, maximum
Shield coverage	
Overall Outside (if OEM specified)	100%
Individual Pairs (if OEM specified)	100%
Attenuation	
Frequency in MHz	dB per 305 M (1,000ft.), maximum
0.7	5.2
1.0	6.5
4.0	14.0
8.0	19.0
16.0	26.0
20.0	29.0
25.0	33.0
31.0	36.0
62.0	52.0
100.0	68.0

4. Fiber Optic:

a. Multimode Fiber:

The multimode fiber optic cable shall be a dual window type installed in conduit for all system locations. A load-bearing support braid shall surround the inner tube for strength during cable installation.

Technical Characteristics:

Bend radius	6.0", minimum Outer jacket, As required
FIBER DIAMETER	50 MICRONS
Cladding	125 microns
Attenuation	
850 nM	3.0 dB per kM, maximum
1,300 nM	1.0 dB per kM, maximum
Effective Modal Bandwidth	• 4700 MHz-kM @ 850 nm
IEEE 802.3 Gbe @ 850 nm	Up to 1000 m
IEEE 802.3 Gbe @ 1300 nm	Up to 600 m
IEEE 802.3 10 Gbe @ 850 nm	Up to 550 m
OFL Bandwith	• 3500 MHz-kM @ 850 nm

AC Power Cable: AC power cable(s) shall be 3-conductor, no. 12 AWG minimum, and rated for 13A-125V and 1,625W. Master AC power, installation specification and requirements, are given in the NEC and herein.

General Purpose RF:

The coaxial cable shall be an RG-6/U type (or equal), minimum and shall be increased in size (i.e. RG-11/U, .500", .750", etc.) as required to meet system design. It may also be used for baseband signals as approved by the OEM.

Technical Characteristics:

Impedance	75 OHM, UNBAL
Center conductor	stranded copper, or copper plated steel or 20 AWG, solid or aluminum
Dielectric	Cellular polyethylene
Shield coverage	95%, copper braid
Connector type	BNC or UHF

Attenuation	
Frequency (k or mHz)	Maximum dB/30.5M (100ft.)
10 kHz	0.20
100 kHz	0.22
1.0 kHz	0.25
4.5 mHz	0.85
10.0 mHz	1.40
100 mHz	5.00

C. Outlet Connection Cables:

1. Telephone:

The Contractor shall provide a connection cable for each TCO telephone jack in the System with 10% spares. The telephone connection cable shall connect the telephone instrument to the TCO telephone jack. The Contractor shall not provide telephone instrument(s) or equipment.

Technical Characteristics:

Length	1.8M (6ft.), minimum
Cable	Voice Grade
Connector	RJ-11/45 compatible male on each end
Size	24 AWG, minimum
Color coding	Required, telephone industry standard

2. Data:

The Contractor shall provide a connection cable for each TCO data jack in the system with 10% spares. The data connection cable shall connect a data instrument to the TCO data jack. The Contractor shall not provide data terminal(s)/equipment.

Technical Characteristics:

Length	1.8M (6 ft.), minimum
Cable	Data grade Category Six
Connector	RJ-45 male on each end
Color coding	Required, data industry standard
Size	24 AWG, minimum

3. Fiber Optic:

The Contractor shall provide a connection cable for each TCO fiber optic connector in the System with 10% spares. The data connection cable shall connect a fiber optic instrument to the TCO fiber optic jack. The Contractor shall not provide fiber optic instrument(s)/equipment.

Technical Characteristics:

Length	1.8M (6 ft.), minimum
Cable	Flexible single conductor with jacket
Connector	LC male on each end
Size	To fit single mode or multimode cable

4. Analog RF:

The Contractor shall provide a connection cable for each TCO analog RF connector in the System with 10% spares. The analog RF connection cable shall connect a analog RF instrument to the TCO analog RF jack. The Contractor shall not provide analog RF equipment.

Technical Characteristics:

Length	1.8M (6 ft.), minimum
Cable	Flexible RG-6/U, minimum
Connector	"F" male on each end //

5. Multipin:

The connector shall have a crimp-on coupling for quick connect/disconnect of wires or cables. The crimp-on connector shall be designed to fit the wire or cable furnished. The connector housing shall be fully enclosed and shielded. It shall be secured to the cable group by screw type compression sleeves.

Technical Characteristics:

Impedance	As required
Working Voltage	500 V
Number of pins	As requires, usually 25 pairs minimum

6. Modular (RJ-45/11 and RJ-45): The connectors shall be commercial types for voice and high speed data transmission applications. he connector shall be compatible with telephone instruments, computer terminals, and other type devices requiring linking through the

modular telecommunications outlet to the System. The connector shall be compatible with UTP and STP cables.

a. Technical Characteristics:

Type	Number of Pins
RJ-11/45	Compatible with RJ45
RJ-45	Eight
Dielectric	Surge
Voltage	1,000V RMS, 60 Hz @ one minute, minimum
Current	2.2A RMS @ 30 Minutes or 7.0A RMS @ 5.0 seconds
Leakage	100 μ A, maximum
Connectability	
Initial contact resistance	20 mili-Ohms, maximum
Insulation displacement	10 mili-Ohms, maximum
Interface	Must interface with modular jacks from a variety of OEMs. RJ-11/45 plugs shall provide connection when used in RJ-45 jacks.
Durability	200 insertions/withdrawals, minimum

Fiber Optic: The connectors shall be commercial types for voice and high speed data transmission applications. The connector shall be compatible with telephone instruments, computer terminals, and other type devices requiring linking through the modular telecommunications outlet to the system.

"F" Type:

The "F" connector shall have a screw type coupling for quick connect/disconnect of coaxial cable/termination's. It shall be a crimp-on connector designed to fit the coaxial cable furnished with integral 12.7 mm (1/2in.) ferrule.

Technical Characteristics:

Impedance	75 Ohms, UNBAL
Working Voltage	500 V //

D. Terminators:

1. Coaxial:

These units shall be metal-housed precision types in the frequency ranges selected. They shall be the screw-on type that has low VSWR when installed and the proper impedance to terminate the required system unit or coaxial cable.

Technical Characteristics:

Frequency	0-1 GHz
Power blocking	As required
Return loss	25 dB
Connectors	"F", "BNC", minimum
Impedance	50 or 75 Ohms, UNBAL

2. Fiber Optic:

These units shall be metal-housed precision types in the frequency ranges selected. They shall be the screw-on type that has low VSWR when installed and the proper impedance to terminate the required system unit or fiber optic cable.

Technical Characteristics:

Frequency	Lightwave
Power blocking	As required
Return loss	25 dB
Connectors	"LC", minimum
Construction	Stainless steel
Impedance	As required

E. Distribution Frames:

A new stand-alone (i.e., self supporting, free standing) MDF shall be provided to interconnect the EPBX and computer room. The MDF shall be modular and equipped with modular terminating mini blocks (i.e. Ericsson, 3M, etc.), and patch panels that are as small as possible and provide all the requirements of this specifications as described herein.

All cable distribution closets and MDFs shall be wired in accordance with industry standards and shall employ "latest state-of-the-art" modular cross-connect devices. The MDF/telephone closet riser cable shall be sized to satisfy all voice requirements plus not less than

50% spare (growth) capacity in each telephone closet which includes a fiber optic backbone. The MDF/telephone closet riser cable shall be sized to satisfy all voice and data requirements plus not less than 50% spare (growth) capacity in each telephone closet which does not include a fiber optic backbone.

The MDF and all intermediate distribution frames shall be connected to the EPBX system ground.

Technical Characteristics:

Telephone	
IDC type unit	As described in Part 2
Contact wires	50 micron of Gold over Nickel
Contact pressure	100 Grams, MIN
110A Punch blocks	Acceptable alternate to IDC
Data	110A blocks as described in Part 2
Fiber optic	Patch panel as described in Part 2
Analog Video	Patch panel as described in Part 2

2.3 TELECOMMUNICATIONS CLOSET REQUIREMENTS

Refer to VA Handbook H-088C3, Telephone System Requirements, for specific TC guidelines for size, power input, security, and backboard mounting requirements. It is the Contractors responsibility to ensure TC compliance with the System Requirements.

2.4 ENVIRONMENTAL REQUIREMENTS

Technical submittals shall identify the environmental specifications for housing the system. These environmental specifications shall identify the requirements for initial and expanded system configurations for:

Floor loading for batteries and cabinets.

Minimum floor space and ceiling heights.

Minimum size of doors for equipment passage.

Power requirements: The bidders shall provide the specific voltage, amperage, phases, and quantities of circuits required.

Air conditioning, heating, and humidity requirements. The bidder shall identify the ambient temperature and relative humidity operating ranges required preventing equipment damage.

Air conditioning requirements (expressed in BTU per hour, based on adequate dissipation of generated heat to maintain required room and equipment standards).

Proposed floor plan based on the expanded system configuration of the bidder's proposed EPBX for this Facility.

Conduit size requirement (between equipment room and console room).

2.5 INSTALLATION KIT

The kit shall be provided that, at a minimum, includes all connectors and terminals, labeling systems, audio spade lugs, barrier strips, punch blocks or wire wrap terminals, heat shrink tubing, cable ties, solder, hangers, clamps, bolts, conduit, cable duct, and/or cable tray, etc., required to accomplish a neat and secure installation. All wires shall terminate in a spade lug and barrier strip, wire wrap terminal or punch block. Unfinished or unlabeled wire connections shall not be allowed. Turn over to the RE all unused and partially opened installation kit boxes, coaxial, fiberoptic, and twisted pair cable reels, conduit, cable tray, and/or cable duct bundles, wire rolls, physical installation hardware. The following are the minimum required installation sub-kits:

A. System Grounding:

The grounding kit shall include all cable and installation hardware required. All radio equipment shall be connected to earth ground via internal building wiring, according to the NEC.

This includes, but is not limited to:

- Coaxial Cable Shields.
- Control Cable Shields.
- Data Cable Shields.
- Equipment Racks.
- Equipment Cabinets.
- Conduits.
- Duct.
- Cable Trays.
- Power Panels.
- Connector Panels.
- Grounding Blocks.

B. Coaxial Cable: The coaxial cable kit shall include all coaxial connectors, cable tying straps, heat shrink tabbing, hangers, clamps, etc., required to accomplish a neat and secure installation.

C. Wire and Cable: The wire and cable kit shall include all connectors and terminals, audio spade lugs, barrier straps, punch blocks, wire wrap

strips, heat shrink tubing, tie wraps, solder, hangers, clamps, labels etc., required to accomplish a neat and orderly installation.

Conduit, Cable Duct, and Cable Tray: The kit shall include all conduit, duct, trays, junction boxes, back boxes, cover plates, feed through nipples, hangers, clamps, other hardware required to accomplish a neat and secure conduit, cable duct, and/or cable tray installation in accordance with the NEC and this document.

Equipment Interface: The equipment kit shall include any item or quantity of equipment, cable, mounting hardware and materials needed to interface the systems with the identified sub-system(s) according to the OEM requirements and this document.

Labels: The labeling kit shall include any item or quantity of labels, tools, stencils, and materials needed to completely and correctly label each subsystem according to the OEM requirements, as-installed drawings, and this document.

Documentation: The documentation kit shall include any item or quantity of items, computer discs, as installed drawings, equipment, maintenance, and operation manuals, and OEM materials needed to completely and correctly provide the system documentation as required by this document and explained herein.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Product Delivery, Storage and Handling:

Delivery: Deliver materials to the job site in OEM's original unopened containers, clearly labeled with the OEM's name and equipment catalog numbers, model and serial identification numbers. The RE may inventory the cable, patch panels, and related equipment.

Storage and Handling: Store and protect equipment in a manner, which will preclude damage as directed by the RE.

B. System Installation:

After the contract's been awarded, and within the time period specified in the contract, the Contractor shall deliver the total system in a manner that fully complies with the requirements of this specification. The Contractor shall make no substitutions or changes in the System without written approval from the RE and PM.

The Contractor shall install all equipment and systems in a manner that complies with accepted industry standards of good practice, OEM instructions, the requirements of this specification, and in a

manner which does not constitute a safety hazard. The Contractor shall insure that all installation personnel understands and complies with all the requirements of this specification.

The Contractor shall install suitable filters, traps, directional couplers, splitters, TC's, and pads for minimizing interference and for balancing the System. Items used for balancing and minimizing interference shall be able to pass telephone and data, and lightwave, and analog signals in the frequency bands selected, in the direction specified, with low loss, and high isolation, and with minimal delay of specified frequencies and signals. The Contractor shall provide all equipment necessary to meet the requirements of Paragraph 2.1.C and the System performance standards.

All passive equipment shall be connected according to the OEM's specifications to insure future correct termination, isolation, impedance match, and signal level balance at each telephone/data outlet.

Where TCOs are installed adjacent to each other, install one outlet for each instrument.

All lines shall be terminated in a suitable manner to facilitate future expansion of the System. There shall be a minimum of one spare 25 pair cable at each distribution point on each floor.

All vertical and horizontal copper and fiber optic, and coaxial cables shall be terminated so any future changes only requires modifications of the existing signal closet equipment only.

Terminating resistors or devices shall be used to terminate all unused branches, outlets, equipment ports of the System, and shall be devices designed for the purpose of terminating fiber optic or twisted pair, and coaxial, and lightwave cables carrying telephone and data, and analog signals in telephone and data, and analog video, and lightwave systems.

Equipment installed outdoors shall be weatherproof or installed in weatherproof enclosures with hinged doors and locks with two keys.

Equipment installed indoors shall be installed in metal cabinets with hinged doors and locks with two keys.

C. Conduit and Signal Ducts:

1. Conduit:

- a. The Contractor shall employ the latest installation practices and materials. The Contractor shall provide conduit, junction boxes,

connectors, sleeves, weatherheads, pitch pockets, and associated sealing materials not specifically identified in this document as GFE. Conduit penetrations of walls, ceilings, floors, interstitial space, fire barriers, etc., shall be sleeved and sealed. The minimum conduit size shall be 19 mm (3/4 in.).

All cables shall be installed in separate conduit and/or signal ducts (exception from the separate conduit requirement to allow telephone cables to be installed in partitioned cable tray with data cables may be granted in writing by the RE if requested.) Conduits shall be provided in accordance with Section 27 05 33, RACEWAYS AND BOXES FOR COMMUNICATIONS SYSTEMS, and NEC Articles 517 for Critical Care and 800 for Communications systems, at a minimum.

When metal, plastic covered, etc., flexible cable protective armor or systems are specifically authorized to be provided for use in the System, their installation guidelines and standards shall be as specified herein, Section 27 05 33, RACEWAYS AND BOXES FOR COMMUNICATIONS SYSTEMS, and the NEC.

When "innerduct" flexible cable protective systems is specifically authorized to be provided for use in the System, it's installation guidelines and standards shall be as the specified herein, Section 27 05 33, RACEWAYS AND BOXES FOR COMMUNICATIONS SYSTEMS, and the NEC.

Conduit (including GFE) fill shall not exceed 40%. Each conduit end shall be equipped with a protective insulator or sleeve to cover the conduit end, connection nut or clamp, to protect the wire or cable during installation and remaining in the conduit.

Electrical power conduit shall be installed in accordance with the NEC. AC power conduit shall be run separate from signal conduit.

When metal, plastic covered, etc., flexible cable protective armor or systems are specifically authorized to be provided for use in the System, their installation guidelines and standards shall be as specified herein, Section 27 05 33, RACEWAYS AND BOXES FOR COMMUNICATIONS SYSTEMS, and the NEC.

Ensure that Critical Care ----- Nurse Call Systems (as identified by NEC Section 517) are completely separated and protected from all other systems.

2. Signal Duct, Cable Duct, or Cable Tray:

The Contractor shall use existing signal duct, cable duct, and/or cable tray, when identified and approved by the RE.

Approved signal and/or cable duct shall be a minimum size of 100 mm x 100 mm (4 in. X 4 in.) inside diameter with removable tops or sides, as appropriate. Protective sleeves, guides or barriers are required on all sharp corners, openings, anchors, bolts or screw ends, junction, interface and connection points.

Approved cable tray shall be fully covered, mechanically and physically partitioned for multiple electronic circuit use, and be UL certified and labeled for use with telecommunication circuits and/or systems. The RE shall approve width and height dimensions.

D. Distribution System Signal Wires and Cables:

1. Wires and cables shall be provided in the same manner and use like construction practices as Fire Protective and other Emergency Systems that are identified and outlined in NFPA 101, Life Safety Code, Chapters 7, 12, and/or 13, NFPA 70, National Electrical Code, Chapter 7, Special Conditions. The wires and cables shall be able to withstand adverse environmental conditions in their respective location without deterioration. Wires and cables shall enter each equipment enclosure, console, cabinet or rack in such a manner that all doors or access panels can be opened and closed without removal or disruption of the cables.

Each wire and cable shall terminate on an item of equipment by direct connection. Spare or unused wire and cable shall be provided with appropriate connectors (female types) that are installed in appropriate punch blocks, barrier strips, patch, or bulkhead connector panels.

Fiber optic cables that are spare, unused or dark shall be provided with Industry Standard "LC" type female connectors installed in appropriate break out, patch, or bulkhead connector panels provided in enclosure(s) and shall be protected from the environment.

Coaxial cables that are spare, unused or dark shall be provided with the cable OEM specified type female connectors installed in appropriate break out, patch, or bulkhead connector panels

provided in enclosure(s) and shall be protected from the environment.

- d. All cable junctions and taps shall be accessible. Provide an 8" X 8" X 4" (minimum) junction box attached to the cable duct or raceway for installation of distribution system passive equipment. Ensure all equipment and tap junctions are accessible.

2. Routing and Interconnection:

Wires or cables between consoles, cabinets, racks and other equipment shall be in an approved conduit, signal duct, cable duct, or cable tray that is secured to building structure.

Wires and cables shall be insulated to prevent contact with signal or current carrying conductors. Wires or cables used in assembling consoles, panels, equipment cabinets and racks shall be formed into harnesses that are bundled and tied. Harnessed wires or cables shall be combed straight, formed and dressed in either a vertical or horizontal relationship to equipment, controls, components or terminations.

Harnesses with intertwined members are not acceptable. Each wire or cable that breaks out from a harness for connection or termination shall have been tied off at that harness or bundle point, and be provided with a neatly formed service loop.

Wires and cables shall be grouped according to service (i.e.: AC, grounds, signal, DC, control, etc.). DC, control and signal cables may be included with any group. Wires and cables shall be neatly formed and shall not change position in the group throughout the conduit run. Wires and cables in approved signal duct, conduit, cable ducts, or cable trays shall be neatly formed, bundled, tied off in 600 mm to 900 mm (24 in. to 36 in.) lengths and shall not change position in the group throughout the run. Concealed splices are not allowed.

Separate, organize, bundle, and route wires or cables to restrict EMI, channel crosstalk, or feedback oscillation inside any enclosure. Looking at any enclosure from the rear (wall mounted enclosures, junction, pull or interface boxes from the front), locate AC power, DC and speaker wires or cables on the left; coaxial, control, microphone and line level audio and data wires or cables, on the right. This installation shall be accomplished with ties and/or fasteners that will not damage or distort the

wires or cables. Limit spacing between tied off points to a maximum of 150 mm (6 inches).

Do not pull wire or cable through any box, fitting or enclosure where change of cable tray or signal or cable duct alignment or direction occurs. Ensure the proper bend radius is maintained for each wire or cable as specified by it's OEM.

Employ temporary guides, sheaves, rollers, and other necessary items to protect the wire or cable from excess tension or damage from bending during installation. Abrasion to wire or cable jackets is not acceptable and will not be allowed. Replace all cables whose jacket has been abraded. The discovery of any abraded and/or damaged cables during the proof of performance test shall be grounds for declaring the entire system unacceptable and the termination of the proof of performance test. Completely cover edges of wire or cable passing through holes in chassis, cabinets or racks, enclosures, pull or junction boxes, conduit, etc., with plastic or nylon grommeting. Cable runs shall be splice free between conduit junction and interface boxes and equipment locations.

Cables shall be installed and fastened without causing sharp bends or rubbing of the cables against sharp edges. Cables shall be fastened with hardware that will not damage or distort them.

Cables shall be labeled with permanent markers at the terminals of the electronic and passive equipment and at each junction point in the System. The lettering on the cables shall correspond with the lettering on the record diagrams.

Completely test all of the cables after installation and replace any defective cables.

Wires or cables that are installed outside of buildings shall be in conduit, secured to solid building structures. If specifically approved, on a case by case basis, to be run outside of conduit, the wires or cables shall be installed, as described herein. The bundled wires or cables must: Be tied at not less than 460 mm (18 in.) intervals to a solid building structure; have ultra violet protection and be totally waterproof (including all connections). The laying of wires or cables directly on roof tops, ladders, drooping down walls, walkways, floors, etc. is not allowed and will not be approved.

- m. Wires or cables installed outside of conduit, cable trays, wireways, cable duct, etc.

Only when specifically authorized as described herein, will wires or cables be identified and approved to be installed outside of conduit. The wire or cable runs shall be UL rated plenum and OEM certified for use in air plenums.

Wires and cables shall be hidden, protected, fastened and tied at 600 mm (24 in.) intervals, maximum, as described herein to building structure.

Closer wire or cable fastening intervals may be required to prevent sagging, maintain clearance above suspended ceilings, remove unsightly wiring and cabling from view and discourage tampering and vandalism. Wire or cable runs, not provided in conduit, that penetrate outside building walls, supporting walls, and two hour fire barriers shall be sleeved and sealed with an approved fire retardant sealant.

Wire or cable runs to system components installed in walls (i.e.: volume attenuators, circuit controllers, signal, or data outlets, etc.) may, when specifically authorized by the RE, be fished through hollow spaces in walls and shall be certified for use in air plenum areas.

- n. Wires or cables installed in underground conduit, duct, etc.

Wires or cables installed in underground installations shall be waterproofed by the inclusion of a water protective barrier (i.e. gel, magma, etc.) or flooding compound between the outside jacket and first shield. Each underground connection shall be accessible in a manhole, recessed ground level junction box, above ground pedestal, etc., and shall be provided with appropriate waterproof connectors to match the cable being installed. Once the System has been tested and found to meet the System performance standards and accepted by VA, the Contractor shall provide waterproof shrink tubing or approved mastic to fully encompass each wire or cable connection and overlay at least 150 mm (6 inches) above each wire or cable jacket trim point.

It is not acceptable to connect waterproofed cable directly to an inside CCS punch block or directly to an equipment connection port. When an under ground cable enters a building,

it shall be routed directly to the closest TC that has been designated as the building's IMTC. The Contractor shall provide a "transition" splice in this TC where the "water proofed" cable enters on one side and "dry" cable exits on the other side. The "transition" splice shall be fully waterproof and be capable of reentry for system servicing. Additionally, the transition splice shall not allow the waterproofing compound to migrate from the water proof cable to the dry cable.

- 3) Warning tape shall be continuously placed 300 mm (12 inches) above buried conduit, cable, etc.

E. Outlet Boxes, Back Boxes, and Faceplates:

Outlet Boxes: Signal, power, interface, connection, distribution, and junction boxes shall be provided as required by the system design, on-site inspection, and review of the contract drawings.

Back Boxes: Back boxes shall be provided as directed by the OEM as required by the approved system design, on-site inspection, and review of the contract drawings.

Face Plates (or Cover Plates): Faceplates shall be of a standard type, stainless steel, anodized aluminum or UL approved cycloc plastic construction and provided by the Contractor for each identified system outlet location. Connectors and jacks appearing on the faceplate shall be clearly and permanently marked.

F. Connectors: Circuits, transmission lines, and signal extensions shall have continuity, correct connection and polarity. A uniform polarity shall be maintained between all points in the system.

1. Wires:

Wire ends shall be neatly formed and where insulation has been cut, heat shrink tubing shall be employed to secure the insulation on each wire. Tape of any type is not acceptable. Audio spade lugs shall be installed on each wire (including spare or unused) end and connect to screw terminals of appropriate size barrier strips. AC barrier strips shall be provided with a protective cover to prevent accidental contact with wires carrying live AC current. Punch blocks are approved for signal, not AC wires. Wire Nut or "Scotch Lock" connectors are not acceptable for signal wire installation.

2. Cables: Each connector shall be designed for the specific size cable being used and installed with the OEM's approved installation tool. Typical system cable connectors include; but, are not limited to: Audio spade lug, punch block, wirewrap, etc.

AC Power: AC power wiring shall be run separately from signal cable.

Grounding:

1. General: The Contractor shall ground all Contractor Installed Equipment and identified Government Furnished Equipment to eliminate all shock hazards and to minimize, to the maximum extent possible, all ground loops, common mode returns, noise pickup, crosstalk, etc. The total ground resistance shall be 0.1 Ohm or less.

The Contractor shall install lightning arrestors and grounding in accordance with the NFPA and this specification.

Gas protection devices shall be provided on all circuits and cable pairs serving building distribution frames located in buildings other than the building in which the // _____ // is located or in any area served by an unprotected distribution system (manhole, aerial, etc.). The Contractor shall install the gas protection devices at the nearest point of entrance in buildings where protection is required and on the same circuits on the MDF in the telephone switch room.

Under no conditions shall the AC neutral, either in a power panel or in a receptacle outlet, be used for system control, subcarrier or audio reference ground.

The use of conduit, signal duct or cable trays as system or electrical ground is not acceptable and will not be permitted. These items may be used only for the dissipation of internally generated static charges (not to be confused with externally generated lightning) that may applied or generated outside the mechanical and/or physical confines of the System to earth ground. The discovery of improper system grounding shall be grounds to declare the System unacceptable and the termination of all system acceptance testing.

2. Cabinet Buss: A common ground buss of at least #10 AWG solid copper wire shall extend throughout each equipment cabinet and be connected to the system ground. Provide a separate isolated ground connection from each equipment cabinet ground buss to the system ground. Do not tie equipment ground busses together.

Equipment: Equipment shall be bonded to the cabinet bus with copper braid equivalent to at least #12 AWG. Self grounding equipment enclosures, racks or cabinets, that provide OEM certified functional ground connections through physical contact with installed equipment, are acceptable alternates.

Cable Shields: Cable shields shall be bonded to the cabinet ground buss with #12 AWG minimum stranded copper wire at only one end of the cable run. Cable shields shall be insulated from each other, faceplates, equipment racks, consoles, enclosures or cabinets; except, at the system common ground point. Coaxial and audio cables, shall have one ground connection at the source; in all cases, cable shield ground connections shall be kept to a minimum.

I. Labeling: Provide labeling in accordance with ANSI/EIA/TIA-606-A.

All lettering for voice and data circuits shall be stenciled using laser printers. Handwritten labels are not acceptable.

Cable and Wires (Hereinafter referred to as "Cable"): Cables shall be labeled at both ends in accordance with ANSI/EIA/TIA-606-A. Labels shall be permanent in contrasting colors. Cables shall be identified according to the System "Record Wiring Diagrams".

Equipment: System equipment shall be permanently labeled with contrasting plastic laminate or bakelite material. System equipment shall be labeled on the face of the unit corresponding to its source.

Conduit, Cable Duct, and/or Cable Tray: The Contractor shall label all conduit, duct and tray, including utilized GFE, with permanent marking devices or spray painted stenciling a minimum of 3 meters (10 ft.) identifying it as the System. In addition, each enclosure shall be labeled according to this standard.

Termination Hardware: The Contractor shall label workstation outlets and patch panel connections using color coded labels with identifiers in accordance with ANSI/EIA/TIA-606-A and the "Record Wiring Diagrams".

3.2 TESTS

A. Interim Inspection:

1. This inspection shall verify that the equipment provided adheres to the installation requirements of this document. The interim inspection will be conducted by a factory-certified representative and witnessed by a Government Representative. Each item of installed

equipment shall be checked to insure appropriate UL certification markings. This inspection shall verify cabling terminations in telecommunications rooms and at workstations adhere to color code for T568A pin assignments and cabling connections are in compliance with ANSI/EIA/TIA standards. Visually confirm Category 6 marking of outlets, faceplates, outlet/connectors and patch cords.

Perform fiber optical field inspection tests via attenuation measurements on factory reels and provide results along with manufacturer certification for factory reel tests. Remove failed cable reels from project site upon attenuation test failure.

The Contractor shall notify the RE, in writing, of the estimated date the Contractor expects to be ready for the interim inspection, at least 20 working days before the requested inspection date.

Results of the interim inspection shall be provided to the RE and PM. If major or multiple deficiencies are discovered, a second interim inspection may be required before permitting the Contractor to continue with the system installation.

The RE and/or the PM shall determine if an additional inspection is required, or if the Contractor will be allowed to proceed with the installation. In either case, re-inspection of the deficiencies noted during the interim inspection(s), will be part of the proof of performance test. The interim inspection shall not affect the Systems' completion date. The Contracting Officer shall ensure all test documents will become a part of the Systems record documentation.

B. Pretesting:

Upon completing the installation of the System, the Contractor shall align and balance the system. The Contractor shall pretest the entire system.

Pretesting Procedure:

During the system pretest, the Contractor shall verify (utilizing the approved spectrum analyzer and test equipment) that the System is fully operational and meets all the system performance requirements of this standard.

The Contractor shall pretest and verify that all System functions and specification requirements are met and operational, no unwanted aural effects, such as signal distortion, noise pulses, glitches, audio hum, poling noise, etc. are present. The

Contractor shall measure and record the aural carrier levels of each system telephone and data channel, at each of the following points in the system:

- 1) Signal Level at each interface point to the distribution system, the last outlet on each trunk line plus all outlets installed as part of this contract.
3. The Contractor shall provide four (4) copies of the recorded system pretest measurements and the written certification that the System is ready for the formal acceptance test shall be submitted to the RE.
- C. Acceptance Test: After the System has been pretested and the Contractor has submitted the pretest results and certification to the RE, then the Contractor shall schedule an acceptance test date and give the RE 30 days written notice prior to the date the acceptance test is expected to begin. The System shall be tested in the presence of a Government Representative and an OEM certified representative. The System shall be tested utilizing the approved test equipment to certify proof of performance and Life Safety compliance. The test shall verify that the total System meets the requirements of this specification. The notification of the acceptance test shall include the expected length (in time) of the test.
- D. Verification Tests:
- Test the UTP and STP backbone copper cabling for DC loop resistance, shorts, opens, intermittent faults, and polarity between conductors, and between conductors and shield, if cable has an overall shield. Test the operation of shorting bars in connection blocks. Test cables after termination and prior to cross-connection.
- Multimode Fiber Optic Cable: Perform end-to-end attenuation tests in accordance with ANSI/EIA/TIA-568-B.3 and ANSI/EIA/TIA-526-14A using Method A, Optical Power Meter and Light Source and Method B, OTDR. Perform verification acceptance test.
- E. Performance Testing:
1. Perform Category 6 tests in accordance with ANSI/EIA/TIA-568-B.1 and ANSI/EIA/TIA-568-B.2. Test shall include the following: wire map, length, insertion loss, return loss, NEXT, PSNEXT, ELFEXT, PSELFEXT, propagation delay and delay skew.

2. Fiber Optic Links: Perform end-to-end fiber optic cable link tests in accordance with ANSI/EIA/TIA-568-B.3.

F. Total System Acceptance Test: The Contractor shall perform verification tests for UTP and STP copper cabling system(s) and the multimode fiber optic cabling system(s) after the complete telecommunication distribution system and workstation outlet are installed.

3.3 TRAINING

Furnish the services of a factory-trained engineer or technician for a total of two four hour classes to instruct designated Facility IRM personnel. Instruction shall include cross connection, corrective, and preventive maintenance of the System and equipment.

Before the System can be accepted by the VA, this training must be accomplished. Training will be scheduled at the convenience of the Facilities Contracting Officer and Chief of Engineering Service.

3.4 GUARANTEE PERIOD OF SERVICE

A. Contractor's Responsibilities:

The Contractor shall guarantee that all installed material and equipment will be free from defects, workmanship, and will remain so for a period of one year from date of final acceptance of the System by the VA. The Contractor shall provide OEM's equipment warranty documents, to the RE (or Facility Contracting Officer if the Facility has taken possession of the building(s)), that certifies each item of equipment installed conforms to OEM published specifications.

The Contractor's maintenance personnel shall have the ability to contact the Contractor and OEM for emergency maintenance and logistic assistance, remote diagnostic testing, and assistance in resolving technical problems at any time. The Contractor and OEM shall provide this contact capability at no additional cost to the VA.

All Contractor installation, maintenance, and supervisor personnel shall be fully qualified by the OEM and must provide two (2) copies of current and qualified OEM training certificates and OEM certification upon request.

Additionally, the Contractor shall accomplish the following minimum requirements during the one year guarantee period: a. Response Time:

- 1) The COTR if the facility has taken possession of the building[s]) are the Contractor's reporting and contact officials for the System trouble calls, during the guarantee period.
 - 2) A standard workweek is considered 8:00 A.M. to 5:00 P.M., Monday through Friday exclusive of Federal Holidays.
 - 3) The Contractor shall respond and correct on-site trouble calls, during the standard work week to:
A routine trouble call within one working days of its report. A routine trouble is considered a trouble which causes a system outlet, station, or patch cord to be inoperable.
An emergency trouble call within 6 hours of its report. An emergency trouble is considered a trouble which causes a subsystem or distribution point to be inoperable at anytime. Additionally, the loss of a minimum of 50 station or system lines shall be deemed as this type of a trouble call.
 - 4) The Contractor shall respond on-site to a catastrophic trouble call within 4 hours of its report. A catastrophic trouble call is considered total system failure.
If a system failure cannot be corrected within four hours (exclusive of the standard work time limits), the Contractor shall be responsible for providing alternate system CSS or TCO equipment, or cables. The alternate equipment and/or cables shall be operational within four hours after the four hour trouble shooting time.
Routine or emergency trouble calls in critical emergency health care facilities (i.e., cardiac arrest, intensive care units, etc.) shall also be deemed as a catastrophic trouble call if so determined by the COTR. The COTR shall notify the Contractor of this type of trouble call at the direction of the Facilities Director.
- b. Required on-site visits during the one year guarantee period 1)
The Contractor shall visit, on-site, for a minimum of eight hours, once every 12 weeks, during the guarantee period, to perform system preventive maintenance, equipment cleaning, and

operational adjustments to maintain the System according to the descriptions identified in this SPEC.

The Contractor shall arrange all Facility visits with the RE or Facility Contracting Officer prior to performing the required maintenance visits.

The Contractor in accordance with the OEM's recommended practice and service intervals shall perform preventive maintenance during a non-busy time agreed to by the RE or Facility Contracting Officer and the Contractor.

The preventive maintenance schedule, functions and reports shall be provided to and approved by the COTR.

- 2) The Contractor shall provide the COTR a type written report itemizing each deficiency found and the corrective action performed during each required visit or official reported trouble call. The Contractor shall provide the RE with sample copies of these reports for review and approval at the beginning of the Total System Acceptance Test. The following reports are the minimum required:

Monthly Report: The Contractor shall provide a monthly summary all equipment and sub-systems serviced during this guarantee period to COTR by the fifth working day after the end of each month. The report shall clearly and concisely describe the services rendered, parts replaced and repairs performed. The report shall prescribe anticipated future needs of the equipment and Systems for preventive and predictive maintenance

Contractor Log: The Contractor shall maintain a separate log entry for each item of equipment and each sub-system of the System. The log shall list dates and times of all scheduled, routine, and emergency calls. Each emergency call shall be described with details of the nature and causes of emergency steps taken to rectify the situation and specific recommendations to avoid such conditions in the future.

- 3) The COTR shall provide the Facility Engineering Officer, two (2) copies of actual reports for evaluation.
 - a) The COTR shall ensure copies of these reports are entered into the System's official acquisition documents.

b) The COTR shall ensure copies of these reports are entered into the System's official technical as-installed documents.

B. Work Not Included: Maintenance and repair service shall not include the performance of any work due to improper use, accidents, other vendor, contractor, owner tampering or negligence, for which the Contractor is not directly responsible and does not control. The Contractor shall immediately notify the COTR in writing upon the discovery of these incidents. The COTR or Facility Contracting Officer will investigate all reported incidents and render findings concerning any Contractor's responsibility.

- - - E N D - - -

THIS PAGE INTENTIONALLY LEFT BLANK

SECTION 27 41 31
MASTER ANTENNA TELEVISION EQUIPMENT AND SYSTEMS

PART 1 - GENERAL

1.1 SECTION SUMMARY

Work covered by this document includes design, engineering, labor, material, products, guarantee, training and services for, and incidental to the complete installation of new and fully operating NFPA listed Master Antenna Television (TV) equipment and systems as detailed herein.

Work shall be complete, complete, labeled, VA Central Office (VACO) tested and certified and ready for operation

1.2 RELATED SECTIONS

Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA AND SAMPLES.

Section 26 05 21, LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES (600 Volts and Below).

Section 27 10 00, STRUCTURED COMMUNICATIONS SYSTEMS CABLING.

Section 27 05 11, REQUIREMENTS FOR COMMUNICATIONS INSTALLATIONS.

Section 27 05 26, GROUNDING AND BONDING FOR COMMUNICATIONS SYSTEMS.

Section 27 05 33, RACEWAYS AND BOXES FOR COMMUNICATIONS SYSTEMS.

Section 27 10 00, STRUCTURED CABLING.

Section 27 15 00, COMMUNICATIONS HORIZONTAL CABLING.

1.3 DEFINITIONS

Provide: Design, engineer, furnish, install, connect complete, test, certify and guarantee.

Work: Materials furnished and completely installed.

Review of contract drawings: A service by the engineer to reduce the possibility of materials being ordered which do not comply with contract documents. The engineer's review shall not relieve the Contractor of responsibility for dimensions or compliance with the contract documents. The reviewer's failure to detect an error does not constitute permission for the Contractor to proceed in error.

Headquarters Technical Review, for National/VA communications and security, codes, frequency licensing, standards, guidelines compliance:

Office of Telecommunications

Special Communications Team (0050P2B)

1335 East West Highway - 3rd Floor

Silver Spring, Maryland 20910

(O) 301-734-0350, (F) 301-734-0360

E. Contractor: Radio Contractor; you; successful bidder

1.4 REFERENCES

A. The installation shall comply fully with all governing authorities, laws and ordinances, regulations, codes and standards, including, but not limited to:

1. United States Federal Law/Codes:

a. Departments of:

1) CFR, Title 15 - Department of Commerce, Under the Information Technology Management Reform Act (Public Law 104-106), the Secretary of Commerce approves standards and guidelines that are developed by the:

Chapter II, National Institute of Standards Technology (NIST - formerly the National Bureau of Standards). Under Section 5131 of the Information Technology Management Reform Act of 1996 and the Federal Information Security Management Act of 2002 (Public Law 107-347), NIST develops - Federal Information Processing Standards Publication (FIPS) 140-2-Security Requirements for Cryptographic Modules.

Chapter XXIII, National Telecommunications and Information Administration (NTIA - aka 'Red Book') Chapter 7.8/9
Federal communications Commission (FCC) Title 47 (CFR), Part 15, Radio Frequency Restriction of Use and Compliance in "Safety of Life" Functions and Locations.

2) CFR, Title 29, Department of Labor, Chapter XVII - Occupational Safety and Health Administration (OSHA), Part 1910 - Occupational Safety and Health Standard:

a) Subpart 7 - Definition and requirements for a National Recognized Testing Laboratory (NRTL - 15 Laboratory's, for complete list, contact

http://www.osha.gov/dts/otpca/nrtl/faq_nrtl.html) (1)

Underwriter's Laboratories (UL):

65	Standard for Wired Cabinets.
468	Standard for Grounding and Bonding Equipment.
1449	Standard for Transient Voltage Surge Suppressors.
1069	Hospital Signaling and Nurse Call Equipment.
60950-1/2	Information Technology Equipment - Safety.

Canadian Standards Association (CSA): same tests as for UL.

Communications Certifications Laboratory (CCL): same tests as for UL.

Intertek Testing Services NA, Inc. (ITSNA formerly Edison Testing Laboratory [ETL]): same tests as for UL.

Subpart 35, Compliance with NFPA 101 - Life Safety Code.

Subpart 36, Design and construction requirements for exit routes.

Subpart 268, Telecommunications.

Subpart 305, Wiring methods, components, and equipment for general use.

- 3) Public Law No. 100-527, Department of Veterans Affairs:
 - a) Office of Telecommunications: Handbook 6100 - Telecommunications.
 - b) Office of Cyber and Information Security (OCIS): Handbook 6500 - Information Security Program. Wireless and Handheld Device Security Guideline Version 3.2, August 15, 2005.
 - c) Spectrum Management FCC and NTIA Radio Frequency Compliance and Licensing Program.
 - d) Office of Cyber and Information Security (OCIS): Handbook 6500 - Information Security Program. Wireless and Handheld Device Security Guideline Version 3.2, August 15, 2005.

Title 42, CFC, Department of Health, Chapter IV Health and Human Services, Subpart 1395(a)(b) Joint Commission on Accreditation of Healthcare Organizations (JCAHO) "a hospital that meets JCAHO accreditation is deemed to meet the Medicare conditions of Participation by meeting Federal Directives:" All guidelines for Life, Personal and Public Safety; and, Essential and Emergency Communications.

CFR, Title 47 - Telecommunications, in addition to FCC: Part 15 - Restrictions of use for Part 15 listed Radio Equipment in Safety of Life/Emergency Functions/Equipment/Locations (also see CFR, Title 15 - Department of Commerce, Chapter XXIII - NTIA):

Part 73	Radio Broadcast Service,
Part 90	Rules and Regulations, Appendix C.
Form 854	Antenna Structure Registration.

Public Law 89-670, Department of Transportation, CFR-49, Part 1, Subpart C - Federal Aviation Administration (FAA): Standards AC 110/460-ID and AC 707/460-2E - Advisory Circulars for Constructions of Antenna Towers. Forms 7450 and 7460-2 - Antenna Construction Registration. 2.

National Codes:

American Institute of Architects (AIA): Guidelines for Healthcare Facilities.

American National Standards Institute/Electronic Industries Association/Telecommunications Industry Association (ANSI/EIA/TIA):

568C	Commercial Building Telecommunications Wiring Standards:
569B	Commercial Building Standard for Telecommunications Pathways and Spaces.
606A	Administration Standard for the Telecommunications Infrastructure of Communications Buildings.
607	Commercial Building Grounding and Bonding

	Requirements for Telecommunications.
REC 127-49	Power Supplies.
RS 27	Tools, Crimping, Solderless Wiring Devices, Recommended Procedures for User Certification.

c. Institute of Electrical and Electronics Engineers (IEEE):

SO/TR 21730:2007	Use of mobile wireless communication and computing technology in healthcare facilities - Recommendations for electromagnetic compatibility (management of unintentional electromagnetic interference) with medical devices.
0739- 5175/08/\$25. 00@2008IEEE	Medical Grade - Mission Critical - Wireless Networks.
C62.41	Surge Voltages in Low-Voltage AC Power Circuits.

d. American Society of Mechanical Engineers (ASME):

Standard 17.4, Guide for Emergency Personnel.

Standard 17.5, Elevator and Escalator Equipment (prohibition of installing non-elevator equipment in Elevator Equipment Room/Mechanical Penthouse).

e. NFPA:

70	National Electrical Code (current date of issue) - Articles 517, 645 and 800.
75	Standard for Protection of Electronic Computer Data- Processing Equipment.
77	Recommended Practice on Static Electricity.
99	Healthcare Facilities.
101	Life Safety Code.

State Hospital Code(s).

Local Codes.

1.5 QUALIFICATIONS

The OEM shall have had experience with three or more installations of systems of comparable size and complexity about type and design as specified herein. Each of these installations shall have performed satisfactorily for at least 1 year after final acceptance by the user. Include the names, locations and point of contact for these installations as a part of the submittal.

The Contractor shall submit certified documentation that they have been an authorized distributor and service organization for the OEM for a minimum of 3 years. The Contractor shall be authorized by the OEM to pass thru the OEM's warranty of the installed equipment to VA. In addition, the OEM and Contractor shall accept complete responsibility for the design, installation, certification, operation, and physical support for the system. This documentation, along with the System Contractor and OEM certifications must be provided in writing as part of the Contractor's Technical submittal.

The Contractor's Communications Technicians assigned to the system shall be fully trained, qualified, and certified by the OEM on the engineering, installation, operation, and testing of the system. The Contractor shall provide formal written evidence of current OEM certification(s) for the installer(s) as a part of the submittal or to the Resident Engineer before being allowed to commence work on the system.

Applicable national, state and local licenses.

Certificate of successful completion of OEM's installation/training school for installing technicians of the equipment being proposed.

1.6 CODES AND PERMITS

Provide all necessary permits and schedule all inspections as identified in the contract's milestone chart, so that the system is proof of performance tested and ready for operation on a date directed by the Owner.

The contractor is responsible to adhere to all codes described herein and associated contractual, state and local codes.

1.7 SCHEDULING

A. After the award of contract, the Contractor shall prepare a detailed schedule (aka milestone chart) using "Microsoft Project" software or equivalent. The Contractor Project Schedule (CPS) shall indicate detailed activities for the projected life of the project. The CPS

shall consist of detailed activities and their restraining relationships. It will also detail manpower usage throughout the project.

- B. It is the responsibility of the Contractor to coordinate all work with the other trades for scheduling, rough-in, and finishing all work specified. The owner will not be liable for any additional costs due to missed dates or poor coordination of the supplying contractor with other trades.

1.8 REVIEW OF CONTRACT DRAWINGS AND EQUIPMENT DATA SUBMITTALS

Submit at one time within 10 days of contract awarding, drawings and product data on all proposed equipment and system. Check for compliance with contract documents and certify compliance with Contractor's "APPROVED" stamp and signature.

Support all submittals with descriptive materials, i.e., catalog sheets, product data sheets, diagrams, and charts published by the manufacturer. These materials shall show conformance to specification and drawing requirements.

Where multiple products are listed on a single cut-sheet, circle or highlight the one that you propose to use. Provide a complete and thorough equipment list of equipment expected to be installed in the system, with spares, as a part of the submittal. Special Communications (TVE-0050P3B - herein after referred to as [0050P3B]) will not review any submittal that does not have this list.

Provide 4 copies to the PM for technical review. The PM will provide a copy to the offices identified in Paragraph 1.3.C and D, at a minimum for compliance review as described herein where each responsible individual(s) should respond to the PM within 10 days of receipt of their acceptance or rejection of the submittal(s).

Interface distribution cabinet layout drawing, as they are to be installed.

Equipment technical literature detailing the electrical and technical characteristics of each item of equipment to be furnished.

- H. Engineering drawings of the system, showing calculated signal levels at the Head End input and output, each input and output distribution point, and signal level at each telecommunications outlet.

1.9 PROJECT RECORD DOCUMENTS (AS BUILTS)

Throughout progress of the work, maintain an accurate record of changes in Contract Documents. Upon completion of Work, transfer recorded changes to a set of Project Record Documents.

The floor plans shall be marked in pen to include the following:

- All device locations with labels.
- Conduit locations.
- Head-end equipment and specific location.
- Wiring diagram.
- Labeling and administration documentation.
- Warranty certificate.
- System test results.

1.10 WARRANTIES AND GUARANTEE

The Contractor shall warrant the installation be free from defect in material and workmanship for a period of 1 year from the date of acceptance of the project by the owner. The Contractor shall agree to remedy covered defects within eight (8) hours of notification of major failures or within twenty-four (24) hours of notification for individual station related problems.

Refer to Part 4 for applicable System Guarantee requirements.

1.11 USE OF THE SITE

Use of the site shall be at the GC's direction.

Coordinate with the GC for lay-down areas for product storage and administration areas.

Coordinate work with the GC and their sub-contractors.

Access to buildings wherein the work is performed shall be directed by the GC.

1.12 DELIVERY, STORAGE, AND HANDLING

Deliver, store, and handle products using means and methods that will prevent damage, deterioration, and loss, including theft.

Store products in original containers.

Coordinate with the GC for product storage. There may be little or no storage space available on site. Plan to potentially store materials off site.

Do not install damaged products. Remove damaged products from the site and replaced with new product at no cost to the Owner.

1.13 PROJECT CLOSEOUT

- A. Prior to final inspection and acceptance of the work, remove all debris, rubbish, waste material, tools, construction equipment, machinery and surplus materials from the project site and thoroughly clean your work area.
- B. Before the project closeout date, the Contractor shall submit:
 - Warranty certificate.
 - Evidence of compliance with requirements of governing authorities such as the Low Voltage Certificate of Inspection.
 - Project record documents.
 - Instruction manuals and software that is a part of the system.
- C. Contractor shall submit written notice that:
 - Contract Documents have been reviewed.
 - Project has been inspected for compliance with contract.
 - Work has been completed in accordance with the contract

PART 2 - PRODUCTS AND FUNCTIONAL REQUIREMENTS

2.1 GENERAL REQUIREMENTS FOR EQUIPMENT AND MATERIALS

Furnish and install a complete and fully operational master antenna TV signal distribution system. Include all amplifiers, power supplies, cables, outlets, attenuators, antennas, and all other parts necessary for the reception and distribution of the off-the-air TV signals.

Coordinate features and select components to form an integrated system.

Match components and interconnections for optimum performance of specified functions.

Expansion Capability: Increase number of stations in the future by 25 percent above those indicated without adding any internal or external components or main trunk cable conductors.

Distribute cable channels to all TV outlets to permit simple connection of EIA standard high definition television (HDTV) receivers.

Deliver at all outlets all HDTV monochrome and color television signals without introducing noticeable effect on picture and color fidelity or sound. System picture fidelity shall be equal to that received from the cable company and other modulated channels.

Provide reception quality at each outlet equal to or better than that received in the area with individual antennas. Deliver at all television outlets a minimum +6.0 dBmv (2,000 microvolts across 75 Ohms) and maximum of +20 dBmv (20,000 microvolts) for each channel at each outlet.

Equipment: Modular type using solid-state components, fully rated for continuous duty unless otherwise indicated. Select equipment for normal operation on input power usually supplied at 110 to 130 V, 60 Hz.

Meet all FCC requirements regarding low radiation and/or interference of RF signal(s). The system shall be designed to prevent direct pickup of signals from the building structure.

Weather-Resistant Equipment: Listed and labeled by an OSHA certified National Recognized Testing Laboratory (NRTL - i.e. UL) for duty outdoors or in damp locations.

2.2 SYSTEM DESCRIPTION

The Contractor is responsible for interfacing the telephone Nurse Call, and existing RF Feeder Cable system.

The Contractor shall continually employ interfacing methods that are approved by the OEM and VA. At a minimum, an acceptable interfacing method requires not only a physical and mechanical connection, but also a matching of signal, voltage, and processing levels with regard to signal quality and impedance. The interface point must adhere to all standards described herein for the full separation of Critical Care and Life Safety systems.

It is not acceptable to utilize the telephone cable system for the control of MATV signals and equipment. The System Contractor shall connect the system ensuring that all NFPA and Underwriters Laboratory, Inc. (UL) Critical Care and Life Safety Circuit and system separation guidelines are satisfied. The System Contractor is not allowed to make any connections to the Telephone System. The Owner shall arrange for the interconnection between the MATV, Nurses Call Systems with the appropriate responsible parties.

All passive distribution equipment shall meet or exceed -80 dB radiation shielding specifications and be provided with screw type audio connectors.

All trunk, branch, and interconnecting cables and unused equipment ports or taps shall be terminated with proper terminating resistors designed for RF, audio and digital cable systems without adapters.

The system shall utilize microprocessor components for all signaling and programming circuits and functions. System program memory shall be non-volatile or protected from erasure from power outages for a minimum of 30 minutes.

Provide a backup battery or a UPS for the system (including each distribution cabinet/point) to allow normal operation and function (as if there was no AC power failure) in the event of an AC power failure or during input power fluctuations for a minimum of 30 minutes.

Plug-in connectors shall be provided to connect all equipment, except coaxial cables and RF transmission line interface points. Coaxial cable distribution points and RF transmission lines shall use coaxial cable connections recommended by the cable OEM and approved by the system OEM. Base band cable systems shall utilize barrier terminal screw type connectors, at a minimum. As an alternate, crimp type connectors installed with a ratchet type installation tool are acceptable provided the cable dress, pairs, shielding, grounding, connections and labeling are the same as the barrier terminal strip connectors. Tape of any type, wire nuts or solder type connections are unacceptable and will not be approved.

All equipment faceplates utilized in the system shall be stainless steel, anodized aluminum or UL approved cycolac plastic for the areas where provided.

Noise filters and surge protectors shall be provided for each equipment interface cabinet, Head End cabinet, control console and local and remote amplifier locations to insure protection from input primary AC power surges and to insure noise glitches are not induced into low voltage data circuits.

Audio Level Processing: The use of telephone cable to distribute MATV signals, carrying system or sub-system AC or DC voltage is not acceptable and will not be approved. Additionally, each control location shall be provided with the equipment required to insure the system can produce its designed audio channel capacity at TV/speaker identified on the contract drawings.

Contractor is responsible for pricing all accessories and miscellaneous equipment required to form a complete and operating system. Unless otherwise noted in this Part, equipment quantities shall be as indicated on the drawings.

2.3 MANUFACTURERS

A. The products specified shall be new, FCC and UL Listed, and produced by OEM manufacturer of record. An OEM of record shall be defined as a company whose main occupation is the manufacture for sale of the items of equipment supplied and which:

08-09M

Maintains a stock of 27 41 31 - 12 replacement parts for the item

submitted,
Maintains engineering drawings, specifications, and operating manuals for the items submitted, and
Has published and distributed descriptive literature and equipment specifications on the items of equipment submitted at least 30 days prior to the Invitation for Bid.

Specifications contained herein as set forth in this document detail the salient operating and performance characteristics of equipment in order for VA to distinguish acceptable items of equipment from unacceptable items of equipment. When an item of equipment is offered or furnished for which there is a specification contained herein, the item of equipment offered or furnished shall meet or exceed the specification for that item of equipment.

The equipment items are the salient requirements of VA to provide an acceptable system described herein.

2.4 PRODUCTS

The system distribution amplifier shall have a frequency range of 491,000 MHz and shall accommodate a minimum of 35 HDTV channels of programming. Gain of the preamplifier shall be 32dB, with an output level of 48dBmV for each HDTV channel processed. The preamplifier shall utilize a hybrid push-pull amplifier module. The preamplifier shall provide gain and slope control ranges of 8dB and 9dB, respectively.

Provide one 8-port passive combiner for the combining of all RF signals into one main trunk run for distribution to all building locations. Bandwidth of combiners shall be 0 to 1,000MHz.

Provide riser rated coaxial cable with a nominal characteristic impedance of 75 Ohms throughout the entire frequency spectrum utilized in this system. Each reel of cable shall be sweep-tested and return-loss tested over the entire frequency range from 50MHz to 750MHz by the manufacturer. Provide RG-6, RG-11 or appropriate minimum .500" Hardline Coaxial cable as required to achieve the specified signal level.

However, all runs over 150' in length shall be RG-11 or .500".

Line Splitters:

Provide low-radiation line splitters with a flat frequency response from 50MHz to 1,000MHz. Provide units of a hybrid design with a 75-ohm match on input and outputs and a VSWR no greater than 1.4:1.

Two way line splitters shall have a signal loss of not more than 3.5dB at each output.

Four way line splitters shall have a signal loss of not more than 7.2dB at each output.

All unused splitter outputs shall be terminated with 75-Ohm terminations.

E. HDTV Outlets:

Provide outlets at each location shown on the plans. Mount in electrical contractor provided 4" square, 2" deep minimum flush electrical boxes as indicated on plans.

Provisions shall be incorporated in the network to prevent 60 Hz AC or DC feedback into the distribution lines.

Outlets shall be designed to cover a frequency range of 10MHz to 1,000MHz. Insertion loss shall not exceed 1.0 db at any frequency within the designated frequency range for a 17dB isolation network. Outlets shall be back-matched from 10 to 1,000MHz. Outlets shall have one F-type connector on the front and two F-type connectors on the rear.

The minimum isolation value between any two outlets shall be 24 db.

F. Television Receivers shall be provided separately by the Owner.

G. Distribution Devices:

1. Distribution Amplifier:

Description: Broadband CATV quality HDTV distribution amplifier.

Specifications:

Frequency Range: 49MHz to 1,000MHz.	Channel Loading: 150.
Flatness: +/- .75dB.	Gain: 32dB.
Output Level: +40dBmV.	Gain Control Range: 10dB.
Slope Control Range: 8dB.	Plug in equalizers as needed.
Attenuator options as needed.	

2. Splitters:

Description: RF signal splitter.

Specifications:

Frequency Range: 5MHz to 1,000MHz.	Outputs: 2, 3, 4 and 8.
Splitter Loss: less than 12 dB.	RFI Shielding: 120dB.

3. Taps:

Description: Directional Coupler Type Taps.

For use in Telecomm closets or accessible cable trays.

Specifications:

1. Frequency Range: 5MHz to 1,000MHz.
2. Outputs: 2, 4 and 8.
3. Isolation Tap Value: Varies.

4. Wall plate Bulkhead Connector and Terminators:

a. Description: Wall plates for termination of CATV signals at television sets.

Impedance: 75 Ohms.

Frequency Band: SUB/VHF/CATV/UHF.

5. "F" Connectors:

a. Coaxial cable connectors and connector inserts shall be designed to provide maximum performance with the cable to be used. Coaxial cables shall be connectorized with the Head End quality 360 degree F or BNC connectors as applicable, meeting or exceeding standard industry and the cable manufacture's specifications. All drop F-connectors shall be hex type crimp or a "Snap and Seal" type connector. Housing to housing (KS to KS) type or 90-degree type connectors shall be used where specified by the OEM.

6. Terminator:

Description: 75-Ohm terminator.

Specifications:

DC blocking.	Bandwidth: 50MHz-890MHz.
Return Loss: greater than 16dB.	Impedance: 75 Ohm.

7. Trunk Cable:

Description: .500 inch, Semi-Rigid Coax, Riser Rated.

Specifications:

1. Maximum Attenuation:

2.92 dB/100ft at 700 MHz.	3.78 dB/100ft at 1000 MHz.
Impedance: 75 Ohm	

8. RG6 Cable:

Description: CATV RG6 double shielded cable CM Rated

Specifications: 1.

Attenuation:

1.48 dB/100ft at 50 MHz.	7.45 dB/100ft at 1000 MHz.
Impedance: 75 Ohm	

9. RG11 Cable:

Description: CATV RG11 cable CM Rated

Specifications: 1.

Attenuation:

0.90 dB/100ft at 50 MHz.	5.04 dB/100ft at 1000 MHz.
Impedance: 75 Ohm	

PART 3 - EXECUTION

3.1 PROJECT MANAGEMENT

Assign a single project manager to this project who will serve as the point of contact for the Owner, the General Contractor, and the Engineer.

The Contractor shall be proactive in scheduling work at the hospital, specifically the Contractor will initiate and maintain discussion with the general contractor regarding the schedule for ceiling cover up and install cables to meet that schedule.

Contact the Office of Telecommunications, Special Communications Team (0050P3B) at (301) 734-0350 to have a VA Certified Telecommunications COTR assigned to the project for telecommunications review, equipment and system approval and co-ordination with VA's Spectrum Management and OCIS Teams.

3.2 COORDINATION WITH OTHER TRADES

Coordinate with the cabling contractor the location of the faceplate and the faceplate opening for the MATV backbox.

Coordinate with the cabling contractor the location of MATV equipment in the Telecommunications Closets.

Before beginning work, verify the location, quantity, size and access for the following:

Isolated ground AC power circuits provided for systems.

Primary, emergency and extra auxiliary AC power generator requirements. Junction boxes, wall boxes, wire troughs, conduit stubs and other related infrastructure for the systems.

System components installed by others.

Overhead supports and rigging hardware installed by others.

- D. Immediately notify the Owner, General Contractor and Consultant in writing of any discrepancies.

3.3 NEEDS ASSESSMENT

Provide a one-on-one meeting with the particular nursing manager of each unit affected by the installation of the new HDTV MATV system. Review the floor plan drawing, educate the nursing manager with the functions of the equipment that is being provided and gather details specific to the individual units; coverage and priorities of calls; staffing patterns; and other pertinent details that will affect system programming and training.

3.4 INSTALLATION

A. General:

Execute work in accordance with National, State and local codes, regulations and ordinances.

Install work neatly, plumb and square and in a manner consistent with standard industry practice. Carefully protect work from dust, paint and moisture as dictated by site conditions. The Contractor will be fully responsible for protection of his work during the construction phase up until final acceptance by the Owner.

Install equipment according to OEM's recommendations. Provide any hardware, adaptors, brackets, rack mount kits or other accessories recommended by OEM for correct assembly and installation.

Secure equipment firmly in place, including receptacles, speakers, equipment racks, system cables, etc:

All supports, mounts, fasteners, attachments and attachment points shall support their loads with a safety factor of at least 5:1.

Do not impose the weight of equipment or fixtures on supports provided for other trades or systems.

Any suspended equipment or associated hardware must be certified by the OEM for overhead suspension.

- d. The Contractor is responsible for means and methods in the design, fabrication, installation and certification of any supports, mounts, fasteners and attachments.
 5. Locate overhead ceiling-mounted loudspeakers as shown on drawings, with minor changes not to exceed 12 inches in any direction:
Mount transformers securely to speaker brackets or enclosures using screws. Adjust torsion springs as needed to securely support speaker assembly.
Speaker back boxes shall be completely filled with fiberglass insulation.
Seal cone speakers to their enclosures to prevent air passing from one side of the speaker to the other.
 6. Finishes for any exposed work such as plates, racks, panels, speakers, etc. shall be approved by the Architect, Owner and 0050P3B.
 7. Coordinate cover plates with field conditions. Size and install cover plates as necessary to hide joints between back boxes and surrounding wall. Where cover plates are not fitted with connectors, provide grommeted holes in size and quantity required. Do not allow cable to leave or enter boxes without cover plates installed.
- B. Equipment Racks:
- Fill unused equipment mounting spaces with blank panels or vent panels. Match color to equipment racks.
- Provide security covers for all devices not requiring routine operator control.
- Provide vent panels and cooling fans as required for the operation of equipment within the OEM' specified temperature limits. Provide adequate ventilation space between equipment for cooling. Follow manufacturer's recommendations regarding ventilation space between amplifiers.
- Provide insulated connections of the electrical raceway to equipment racks.
- Provide continuous raceway and conduit with no more than 40 percent fill between wire troughs and equipment racks for all non-plenum-rated cable. Ensure each system is mechanically separated from each other in the wireway.
- C. Wiring Practice - in addition to the mandatory infrastructure requirements outlined in VA Construction Specification, Section 27 10

00, STRUCTURED COMMUNICATIONS CABLING SYSTEM, the following additional practices shall be adhered to:

Comply with requirements for raceways and boxes specified in Division 26, Section 26 05 33, RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS.

Execute all wiring in strict adherence to the National Electrical Code, applicable local building codes and standard industry practices.

Where raceway is to be EMT (conduit), wiring of differing classifications shall be run in separate conduit. Where raceway is to be an enclosure (rack, tray, wire trough, utility box) wiring of differing classifications, which share the same enclosure, shall be mechanically partitioned and separated by at least 4 inches. Where Wiring of differing classifications must cross, they shall cross perpendicular to one another.

Do not splice wiring anywhere along the entire length of the run. Make sure cables are fully insulated and shielded from each other and from the raceway for the entire length of the run.

Do not pull wire through any enclosure where a change of raceway alignment or direction occurs. Do not bend wires to less than radius recommended by manufacturer.

Replace the entire length of the run of any wire or cable that is damaged or abraided during installation. There are no acceptable methods of repairing damaged or abraided wiring.

Use wire pulling lubricants and pulling tensions as recommended by the OEM.

Use grommets around cut-outs and knock-outs where conduit or chase nipples are not installed.

Do not use tape-based or glue-based cable anchors.

Ground shields and drain wires as indicated by the drawings.

Field wiring entering equipment racks shall be terminated as follows:

Provide ample service loops at harness break-outs and at plates, panels and equipment. Loops should be sufficient to allow plates, panels and equipment to be removed for service and inspection.

Line level and speaker level wiring may be terminated inside the equipment rack using specified terminal blocks (see "Products").

Provide 15 percent spare terminals inside each rack. Microphone level wiring may only be terminated at the equipment served.

If specified terminal blocks are not designed for rack mounting, utilize 3/4 inch plywood or 1/8 inch thick aluminum plates/blank panels as a mounting surface. Do not mount on the bottom of the rack.

Employ permanent strain relief for any cable with an outside diameter of 1 inch or greater.

Use only balanced audio circuits unless noted otherwise

Make all connections as follows:

Make all connections using rosin-core solder or mechanical connectors appropriate to the application.

For crimp-type connections, use only tools that are specified by the manufacturer for the application.

Use only insulated spade lugs on screw terminals. Spade lugs shall be sized to fit the wire gauge. Do not exceed two lugs per terminal.

Wire nuts, electrical tape or "Scotch Lock" connections are not acceptable for any application.

D. Cable Installation - In addition to the mandatory infrastructure requirements outlined in VA Construction Specification, Section 27 10 00, STRUCTURED CABLING the following additional practices shall be adhered to:

Support cable on maximum 4'-0" centers. Acceptable means of cable support are cable tray, j-hooks, and bridal rings. Velcro wrap cable bundles loosely to the means of support with plenum rated Velcro straps. Plastic tie wraps are not acceptable as a means to bundle cables.

Run cables parallel to walls.

Install maximum of 10 cables in a single row of J-hooks. Provide necessary rows of J-hooks as required by the number of cables.

Do not lay cables on top of light fixtures, ceiling tiles, mechanical equipment, or ductwork. Maintain at least 2'-0" clearance from all shielded electrical apparatus.

All cables shall be tested after the total installation is fully complete. All test results are to be documented. All cables shall pass acceptable test requirements and levels. Contractor shall remedy any cabling problems or defects in order to pass or comply

with testing. This includes the re-pull of new cable as required at no additional cost to the Owner.

Ends of cables shall be properly terminated on both ends per industry and OEM's recommendations.

Provide proper temporary protection of cable after pulling is complete before final dressing and terminations are complete. Do not leave cable lying on floor. Bundle and tie wrap up off of the floor until you are ready to terminate.

Cover the end of the overall jacket with a 1 inch (minimum) length of transparent heat-shrink tubing. Cut unused insulated conductors 2 inches (minimum) past the heat-shrink, fold back over jacket and secure with cable-tie. Cut unused shield/drain wires 2 inches (minimum) past the Heatshrink and serve as indicated below.

Cover shield/drain wires with heat-shrink tubing extending back to the overall jacket. Extend tubing 1/4 inch past the end of unused wires, fold back over jacket and secure with cable tie.

For each solder-type connection, cover the bare wire and solder connection with heat-shrink tubing.

Terminate conductors; no cable shall contain unterminated elements.

Make terminations only at outlets and terminals.

Splices, Taps, and Terminations: Arrange on numbered terminal strips in junction, pull, and outlet boxes; terminal cabinets; and equipment enclosures. Cables may not be spliced.

Bundle, lace, and train conductors to terminal points without exceeding OEM's limitations on bending radii. Install lacing bars and distribution spools.

Cold-Weather Installation: Bring cable to room temperature before dereeling. Heat lamps shall not be used.

Cable shall not be run through structural members or be in contact with pipes, ducts, or other potentially damaging items.

E. Labeling:

Clearly, consistently, logically and permanently mark switches, connectors, jacks, relays, receptacles and electronic and other equipment.

Engrave and paint fill all receptacle panels using 1/8 inch (minimum) high lettering and contrasting paint.

For rack-mounted equipment, use engraved Lamacoid labels with white 1/8 inch (minimum) high lettering on black background. Label the front and back of all rack-mounted equipment.

Where multiple pieces of equipment reside in the same rack group, clearly and logically label each indicating to which room, channel, receptacle location, etc. they correspond.

Permanently label cables at each end, including intra-rack connections. Labels shall be covered by the same, transparent heat-shrink tubing covering the end of the overall jacket. Alternatively, computer generated labels of the type which include a clear protective wrap may be used.

Contractor's name shall appear no more than once on each continuous set of racks. The Contractor's name shall not appear on wall plates or portable equipment.

Ensure each OEM supplied equipment has permanently attached/marked the appropriate UL Labels/Marks for the service the equipment is performed. Equipment installed not bearing these UL marks will not be allowed to be part of the system. The Contractor shall bear all costs required to provide replacement equipment with approved UL marks.

3.5 PROTECTION OF NETWORK DEVICES

Contractor shall protect network devices during unpacking and installation by wearing manufacturer approved electrostatic discharge (ESD) wrist straps tied to chassis ground. The wrist strap shall meet OSHA requirements for prevention of electrical shock, should technician encounter high voltage.

3.6 CUTTING AND PATCHING

It shall be the responsibility of the contractor to keep their work area clear of debris and clean area daily at completion of work. It shall be the responsibility of the contractor to patch and paint any wall or surface that has been disturbed by the execution of this work. The Contractor shall be responsible for providing any additional cutting, drilling, fitting or patching required that is not indicated as provided by others to complete the Work or to make its parts fit together properly.

The Contractor shall not damage or endanger a portion of the Work or fully or partially completed construction of the Owner or separate contractors by cutting, patching or otherwise altering such

construction, or by excavation. The Contractor shall not cut or otherwise alter such construction by the Owner or a separate contractor except with written consent of the Owner and of such separate contractor; such consent shall not be unreasonably withheld. The Contractor shall not unreasonably withhold from the Owner or a separate Contractor, the Contractor's consent to cutting or otherwise altering the work.

- E. Where coring of existing (previously installed) concrete is specified or required, including coring indicated under unit prices, the location of such coring shall be clearly identified in the field and the location shall be approved by the Project Manager prior to commencement of coring work.

3.7 FIREPROOFING

Where MATV cables penetrate fire rated walls, floors and ceilings, fireproof the opening.

Provide conduit sleeves (if not already provided by electrical contractor) for cables that penetrate fire rated walls. After the cabling installation is complete, install fire proofing material in and around all conduit sleeves and openings. Install fire proofing material thoroughly and neatly. Seal all floor and ceiling penetrations.

Use only materials and methods that preserve the integrity of the fire stopping system and its rating.

3.8 GROUNDING

Ground cable shields and equipment to eliminate shock hazard and to minimize ground loops, commonmode returns, noise pickup, cross talk, and other impairments.

Signal Ground Terminal: Locate at main equipment cabinet. Isolate from power system and equipment grounding.

Install grounding electrodes as specified in Division 26, Section 26 05 26, GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS.

Do not use "3rd or 4th" wire internal electrical system conductors for ground.

Do not connect system ground to the building's external lightning protection system.

Do not "mix grounds" of different systems.

PART 4 - TESTING/GUARANTEE/TRAINING

4.1 SYSTEM CLASSIFICATION

The HDTV MATV System is FCC and NFPA listed. Therefore, the following testing and guaranty provisions are the minimum to be performed and provided by the contractor and Warranted by the OEM.

4.2 PROOF OF PERFORMANCE TESTING

A. Intermediate Testing:

After completion of 25 - 30 percent of the installation of a head end cabinet(s) and equipment, one wing of HDTV MATV outlets //and interconnection to the corresponding Nurse Call (Code Blue) System Patient Head Wall Units // and prior to any further work, this portion of the system must be pretested, inspected, and certified. Each item of installed equipment shall be checked to ensure appropriate FCC listing and UL certification labels are affixed, NFPA, Emergency, Safety, and JCAHCO guidelines are followed, and proper installation practices are followed. The intermediate test shall include a full operational test.

The inspection and test will be conducted by a factory-certified contractor representative and witnessed by a Government Representative. The results of the inspection will be officially recorded by a local Government Representative and maintained on file by the Resident Engineer (RE), until completion of the entire project. The results will be compared to the Acceptance Test results. An identical inspection may be conducted between the 65 - 75percent of the system construction phase, at the direction of the Resident Engineer.

B. Pretesting:

Upon completing installation of the system, the Contractor shall align, balance, and completely pretest the entire system under full operating conditions.

Pretesting Procedure:

During the system pretest the Contractor shall verify (utilizing approved test equipment) that the system is fully operational and meets all the system performance requirements of this standard. The Contractor shall pretest and verify that all system functions and specification requirements are met and operational, no unwanted aural effects, such as signal distortion, noise pulses, glitches, audio hum, poling noise, etc. are present. At a

minimum, each of the following locations shall be fully pretested:

Antennas.

Lightning Grounds.

Head End.

Local and Remote Control Units/Enunciation Panels.

All Networked locations.

System interface locations (i.e.PA, Auditorium Audio, etc.).

System trouble reporting.

UPS operation.

Primary and Emergency AC Power Requirements

Extra Auxiliary Generator Requirements.

The Contractor shall provide 4 copies of the recorded system pretest measurements and the written certification that the system is ready for the formal acceptance test shall be submitted to the Resident Engineer.

C. Acceptance Test:

After the system has been pre-tested and the Contractor has submitted the pretest results and certification to the Resident Engineer, then the Contractor shall schedule an acceptance test date and give the Resident Engineer 30 days written notice prior to the date the acceptance test is expected to begin. The system shall be tested in the presence of a Government Representative and an OEM certified representative. The system shall be tested utilizing the approved test equipment to certify proof of performance and FCC compliance. The test shall verify that the total system meets all the requirements of this specification. The notification of the acceptance test shall include the expected length (in time) of the test.

The acceptance test shall be performed on a "go-no-go" basis. Only those operator adjustments required to show proof of performance shall be allowed. The test shall demonstrate and verify that the installed system does comply with all requirements of this specification under operating conditions. The system shall be rated as either acceptable or unacceptable at the conclusion of the test. Failure of any part of the system that precludes completion of system testing, and which cannot be repaired in 4 hours, shall be cause for terminating the acceptance test of the system. Repeated

failures that result in a cumulative time of 8 hours to affect repairs shall cause the entire system to be declared unacceptable. Retesting of the entire system shall be rescheduled at the convenience of the Government.

D. Acceptance Test Procedure:

1. Physical and Mechanical Inspection:

The COTR will tour all major areas where the system is and all sub-systems are completely and properly installed to insure they are operationally ready for proof of performance testing. A system inventory including available spare parts will be taken at this time. Each item of installed equipment shall be checked to ensure appropriate UL certification labels are affixed.

The system diagrams, record drawings, equipment manuals, Telecommunications Infrastructure Plant (TIP) Auto CAD Disks, intermediate, and pretest results shall be formally inventoried and reviewed.

Failure of the system to meet the installation requirements of this specification shall be grounds for terminating all testing.

2. Operational Test:

After the Physical and Mechanical Inspection, the antennas, head end terminating and control equipment shall be checked to verify that it meets all performance requirements outlined herein. A spectrum analyzer and sound level meter shall be utilized to accomplish this requirement.

Following the Antennas and Head End equipment test, the local and remote control unit be connected to the Head End equipment's output test tap to ensure there are no signal distortions such as intermodulation, data noise, popping sounds, erratic system functions, on any function.

The distribution system shall be checked at each interface, junction, and distribution point, first, middle, and last leg to verify that the HDTV MATV video, audio and control signals meets all system performance standards.

Each HDTV MATV outlet shall be functionally tested at the same time utilizing the Contractor's approved hospital grade TV receiver and Spectrum Analyzer.

The red system and volume stepper switches shall be checked to insure proper operation of the pillow speaker, the volume stepper and the red system (if installed).

Once these tests have been completed, each installed sub-system function shall be tested as a unified, functioning and fully operating system.

Individual Item Test: The VACO Government Representative will select individual items of equipment for detailed proof of performance testing until 100percent of the system has been tested and found to meet the contents of this specification. Each item shall meet or exceed the minimum requirements of this document.

3. Test Conclusion:

At the conclusion of the Acceptance Test, using the generated punch list (or discrepancy list) the VA and the Contractor shall jointly agree to the results of the test, and reschedule testing on deficiencies and shortages with the Resident Engineer. Any retesting to comply with these specifications will be done at the Contractor's expense.

If the system is declared unacceptable without conditions, all rescheduled testing expenses will be borne by the Contractor. E.

Acceptable Test Equipment:

1. The test equipment shall furnished by the Contractor shall have a calibration tag of an acceptable calibration service dated not more than 12 months prior to the test. As part of the submittal, a test equipment list shall be furnished that includes the make and model number of the following type of equipment as a minimum:
 - Spectrum Analyzer.
 - Signal Level Meter.
 - Volt-Ohm Meter.
 - Sound Pressure Level (SPL) Meter.
 - Oscilloscope.
 - Pillow Speaker Test Set (Pillow Speaker with appropriate load and cross connections in lieu of the set is acceptable).

4.3 SYSTEM GUARANTEE PERIOD OF SERVICE

A. Contractor's Responsibility:

The Contractor shall guarantee that all provided material and equipment will be free from defects, workmanship and will remain so for a period of one year from date of final acceptance of the system by the VA. The Contractor shall provide OEM's equipment warranty documents, to the Resident Engineer (or Facility Contracting Officer if the Facility has taken possession of the building), that certifies each item of equipment installed conforms to OEM published specifications.

The Contractor's maintenance personnel shall have the ability to contact the Contractor and OEM for emergency maintenance and logistic assistance, remote diagnostic testing, and assistance in resolving technical problems at any time. This contact capability shall be provided by the Contractor and OEM at no additional cost to the VA.

All Contractor maintenance and supervisor personnel shall be fully qualified by the OEM and must provide 2 copies of current and qualified OEM training certificates and OEM certification upon request.

Additionally, the Contractor shall accomplish the following minimum requirements during the Two Year Guarantee Period: a. Response Time during the Two Year Guarantee Period:

The COTR (if the system has been turned over to the Facility) is the Contractor's only official reporting and contact official for MATV system trouble calls, during the guarantee period.

A standard work week is considered 8:00 A.M. to 5:00 P.M. or as designated by the COTR, Monday through Friday exclusive of Federal Holidays.

The Contractor shall respond and correct on-site trouble calls, during the standard work week to:

A routine trouble call within 1 working day of its report. A routine trouble is considered a trouble that causes a pillow speaker or cordset, 1 master IC control station, room station or emergency station to be inoperable.

Routine trouble calls in critical emergency health care facilities (i.e., cardiac arrest, intensive care units,

etc.) shall also be deemed as an emergency trouble call. The COTR shall notify the Contractor of this type of trouble call.

c) An emergency trouble call within 4 hours of its report. An emergency trouble is considered a trouble that causes a sub-system (ward), distribution point, terminal cabinet, or all call system to be inoperable at anytime.

4) If a HDTV MATV component failure cannot be corrected within 6 hours (exclusive of the standard work time limits), the Contractor shall be responsible for providing alternate HDTV MATV equipment. The alternate equipment/system shall be operational within a maximum of 18 hours after the 6 hour trouble shooting time and restore the effected location operation to meet the system performance standards. If any sub-system or major system trouble cannot be corrected within one working day, the Contractor shall furnish and install compatible substitute equipment returning the system or sub-system to full operational capability, as described herein, until repairs are complete.

b. Required On-Site Visits during the One Year Guarantee Period:

The Contractor shall visit, on-site, as necessary, during the guarantee period, to perform system preventive maintenance, equipment cleaning, and operational adjustments to maintain the system according the descriptions identified in this document.

The Contractor shall arrange all Facility visits with the COTR prior to performing the required maintenance visits.

Preventive maintenance shall be performed by the Contractor in accordance with the OEM's recommended practice and service intervals during non-busy time agreed to by the COTR and Contractor.

The preventive maintenance schedule, functions and reports shall be provided to and approved by the COTR.

The Contractor shall provide the COTR a type written report itemizing each deficiency found and the corrective action performed during each required visit or official reported trouble call. The Contractor shall provide the COTR with sample copies of these reports for review and approval at the

beginning of the Acceptance Test. The following reports are the minimum required:

The Contractor shall provide a monthly summary all equipment and sub-systems serviced during this guarantee period to COTR by the fifth (5th) working day after the end of each month. The report shall clearly and concisely describe the services rendered, parts replaced and repairs performed. The report shall prescribe anticipated future needs of the equipment and systems for preventive and predictive maintenance.

The Contractor shall maintain a separate log entry for each item of equipment and each sub-system of the system. The log shall list dates and times of all scheduled, routine, and emergency calls. Each emergency call shall be described with details of the nature and causes of emergency steps taken to rectify the situation and specific recommendations to avoid such conditions in the future.

- 6) The COTR shall convey to the Facility Engineering Officer, 2 copies of actual reports for evaluation.

The COTR shall ensure a copy of these reports is entered into the system's official acquisition documents.

The Facility Chief Engineer shall ensure a copy of these reports is entered into the system's official technical record documents.

- B. Work Not Included: Maintenance and repair service shall not include the performance of any work due to improper use; accidents; other vendor, contractor, or owner tampering or negligence, for which the Contractor is not directly responsible and does not control. The Contractor shall immediately notify the COTR in writing upon the discovery of these incidents. The COTR will investigate all reported incidents and render

4.4 TRAINING

Provide thorough training of the owner's engineering and maintenance staff.

Provide the following minimum training times and durations:

24 hours prior to opening

24 hours during the opening week

24 hours for supervisors and system administrators - -

- E N D - - -

SECTION 27 52 23
NURSE CALL AND CODE BLUE SYSTEMS

PART 1 - GENERAL

1.1 SECTION SUMMARY

Work covered by this document includes design, engineering, labor, material and products, equipment warranty and system guarantee, training and services for, and incidental to, the complete installation of new and fully operating National Fire Protection Association (NFPA) - Life Safety Code 101.3-2 (a) Labeled and (b) Listed, Emergency Service Nurse-Call and/or Life Safety listed Code Blue Communication System and associated equipment (here-in-after referred to as the System) provided in approved locations indicated on the contract drawings. These items shall be tested and certified capable of receiving, distributing, interconnecting and supporting Nurse-Call and/or Code Blue communications signals generated local and remotely as detailed herein.

Work shall be complete, Occupational Safety and Health Administration (OSHA), National Recognized Testing Laboratory (NRTL - i.e. Underwriters Laboratory [UL]) Listed and Labeled; and VA Central Office (VACO), Telecommunications Voice Engineering (TVE 005OP3B) tested, certified and ready for operation.

The System shall be delivered free of engineering, manufacturing, installation, and functional defects. It shall be designed, engineered and installed for ease of operation, maintenance, and testing.

The term "provide", as used herein, shall be defined as: designed, engineered, furnished, installed, certified, tested, and guaranteed by the Contractor.

Specification Order of Precedence: In the event of a conflict between the text of this document and the Project's Contract Drawings outlined and/or cited herein; **THE TEXT OF THIS DOCUMENT TAKES PRECEDENCE. HOWEVER, NOTHING IN THIS DOCUMENT WILL SUPERSEDE APPLICABLE EMERGENCY LAWS AND REGULATIONS, SPECIFICALLY NATIONAL AND/OR LOCAL LIFE AND PUBLIC SAFETY CODES.** The Local Fire Marshall and/or COTR are the only authorities that may modify this document's EMERGENCY CODE COMPLIANCE REQUIREMENTS, on a case by case basis, in writing and confirmed by COTR and TVE-005OP3B. The COTR is the only approving authority for other amendments to this document that may be granted, on a case by case

basis, in writhing with technical concurrencies by VA's COTR and identified Facility Project Personnel.

- F. The Original Equipment Manufacturer (OEM) and Contractor shall ensure that all management, sales, engineering and installation personnel have read and understand the requirements of this specification before the system is designed, engineered, delivered and provided. The Contractor shall furnish a written statement stating this requirement as a part of the technical submittal that includes each name and certification, including the OEMs. The Contractor is cautioned to obtain in writing, all approvals for system changes relating to the published contract specifications and drawings, from the PM and/or the RE before proceeding with the change.

1.2 RELATED SECTIONS

- A. 01 33 23 - Shop Drawings, Product Data and
- B. Samples. 07 84 00 - Firestopping.
- C. 26 05 21 - Low - Voltage Electrical Power Conductors and Cables (600 Volts and Below).
- D. 27 05 11 - Requirements for Communications Installations.
- E. 27 05 26 - Grounding and Bonding for Communications Systems.
- F. 27 05 33 - Raceways and Boxes for Communications Systems.
- G. 27 10 00 - TIP Structured Communications Systems Cabling.
- H. 27 11 00 - TIP Communications Interface and Equipment Rooms Fittings.
- I. 27 15 00 - TIP Communications Horizontal and Vertical Cabling.
- K. 27 41 31 / 41 - Master Antenna Television Equipment and Systems and/or Extension.
- N. 10 25 13 - Patient Bed Service Walls.

1.3 DEFINITION

Provide: Design, engineer, furnish, install, connect complete, test, certify and guarantee.

Work: Materials furnished and completely installed.

Review of contract drawings: A service by the engineer to reduce the possibility of materials being ordered which do not comply with contract documents. The engineer's review shall not relieve the Contractor of responsibility for dimensions or compliance with the contract documents. The reviewer's failure to detect an error does not constitute permission for the Contractor to proceed in error.

D. Headquarters (aka VACO) Technical Review, for National and VA Communications and Security, Codes, Frequency Licensing Standards, Guidelines and Compliance:

Office of Telecommunications
Special Communications Team (005OP3B)
1335 East West Highway - 3rd Floor
Silver Spring, Maryland 20910,
(O) 301-734-0350, (F) 301-734-0360

H. Contractor: Systems Contractor; you; successful bidder.

1.4 REFERENCES

A. The installation shall comply fully with all governing authorities, laws and ordinances, regulations, codes and standards, including, but not limited to:

1. United States Federal Law:

a. Departments of:

1) Commerce, Consolidated Federal Regulations (CFR), Title 15 - Under the Information Technology Management Reform Act (Public Law 104-106), the Secretary of Commerce approves standards and guidelines that are developed by the:

Chapter II, National Institute of Standards Technology (NIST - formerly the National Bureau of Standards). Under Section 5131 of the Information Technology Management Reform Act of 1996 and the Federal Information Security Management Act of 2002 (Public Law 107-347), NIST develops - Federal Information Processing Standards Publication (FIPS) 140-2-Security Requirements for Cryptographic Modules.

Chapter XXIII, National Telecommunications and Information Administration (NTIA - aka 'Red Book') Chapter 7.8 / 9; CFR, Title 47 Federal communications Commission (FCC) Part 15, Radio Frequency Restriction of Use and Compliance in "Safety of Life" Functions & Locations.

2) FCC - Communications Act of 1934, as amended, CFR, Title 47 - Telecommunications, in addition to Part 15 - Restrictions of use for Part 15 listed Radio Equipment in Safety of Life / Emergency Functions / Equipment/ Locations (also see CFR, Title 15 - Department of Commerce, Chapter XXIII - NTIA):

Part 15 - Restrictions of use for Part 15 listed Radio Equipment in Safety of Life / Emergency Functions / Equipment/Locations.

Part 58 - Television Broadcast Service.

Part 90 - Rules and Regulations, Appendix C.

Health, (Public Law 96-88), CFR, Title 42, Chapter IV Health & Human Services, CFR, Title 46, Subpart 1395(a)(b) JCAHO "a hospital that meets JCAHO accreditation is deemed to meet the Medicare conditions of Participation by meeting Federal Directives:"

a) All guidelines for Life, Personal and Public Safety; and, Essential and Emergency Communications.

Labor, CFR, Title 29, Part 1910, Chapter XVII - Occupational Safety and Health Administration (OSHA), Occupational Safety and Health Standard:

a) Subpart 7 - Definition and requirements (for a NRTL - 15 Laboratory's, for complete list, contact http://www.osha.gov/dts/otpca/nrtl/fag_nrtl.html): 1)

UL:

44-02 - Standard for Thermoset-Insulated Wires and Cables.

65 - Standard for Wired Cabinets.

83-03 - Standard for Thermoplastic-Insulated Wires and Cables.

467-01 - Standard for Electrical Grounding and Bonding Equipment

468 - Standard for Grounding and Bonding Equipment.

486A-01 - Standard for Wire Connectors and Soldering Lugs for Use with Copper Conductors

486C-02 - Standard for Splicing Wire Connectors.

486D-02 - Standard for Insulated Wire Connector Systems for Underground Use or in Damp or Wet Locations.

486E-00 - Standard for Equipment Wiring Terminals for Use with Aluminum and/or Copper Conductors.

493-01 - Standard for Thermoplastic-Insulated Underground Feeder and Branch Circuit Cable.

514B-02 - Standard for Fittings for Cable and

Conduit.

1069 - Hospital Signaling and Nurse Call Equipment.

1449 - Standard for Transient Voltage Surge

Suppressors.

1479-03 - Standard for Fire Tests of Through-

Penetration Fire Stops.

1666 - Standard for Wire/Cable Vertical (Riser) Tray

Flame Tests.

1863 - Standard for Safety, Communications Circuits

Accessories.

2024 - Standard for Optical Fiber Raceways.

60950-1/2 - Information Technology Equipment -

Safety.

2) Canadian Standards Association (CSA): same tests as for UL.

3) Communications Certifications Laboratory (CCL): same tests as for UL.

4) Intertek Testing Services NA, Inc. (ITSNA formerly Edison Testing Laboratory [ETL]): same tests as for UL.

Subpart 35 - Compliance with NFPA 101 - Life Safety Code.

Subpart 36 - Design and construction requirements for exit routes.

Subpart 268 - Telecommunications.

Subpart 305 - Wiring methods, components, and equipment for general use.

5) Department of Transportation, CFR, Title 49 (Public Law 89-670), Part 1, Subpart C - Federal Aviation Administration (FAA):

Standards AC 110/460-ID & AC 707 / 460-2E - Advisory

Circulars for Construction of Antenna Towers.

Forms 7450 and 7460-2 - Antenna Construction Registration.

6) Veterans Affairs (Public Law No. 100-527), CFR, Title 38, Volumes I & II:

a) Office of Telecommunications:

1) Handbook 6100 - Telecommunications.

Spectrum Management FCC & NTIA Radio Frequency

Compliance and Licensing Program.

Special Communications Proof of Performance Testing,

VACO Compliance and Life Safety Certification(s).

- b) Office of Cyber and Information Security (OCIS):
Handbook 6500 - Information Security Program.
Wireless and Handheld Device Security Guideline Version
3.2, August 15, 2005.
- c) VA's National Center for Patient Safety - Veterans
Health Administration Warning System, Failure of Medical
Alarm Systems using Paging Technology to Notify Clinical
Staff, July 2004.
- d) VA's Center for Engineering Occupational Safety and Health,
concurrence with warning identified in VA Directive 7700.
- e) Office of Construction and Facilities Management (CFM):
 - 1) Master Construction Specifications (PG-18-1).
 - 2) Standard Detail and CAD Standards (PG-18-4).
 - 3) Equipment Guide List (PG-18-5).
 - 4) Electrical Design Manual for VA Facilities (PG 18-
10), Articles 7 & 8.
 - 5) Minimum Requirements of A/E Submissions (PG 18-15):
Volume B, Major New Facilities, Major Additions; and
Major Renovations, Article VI, Paragraph B.
Volume C - Minor and NRM Projects, Article III,
Paragraph S.
Volume E - Request for Proposals Design/Build
Projects, Article II, Paragraph F.
 - 6) Mission Critical Facilities Design Manual (Final Draft
- 2007).
 - 7) Life Safety Protected Design Manual (Final Draft
- 2007).
 - 8) Solicitation for Offerors (SFO) for Lease Based Clinics
- (05-2009).

b. Federal Specifications (Fed. Specs.):

- 1) A-A-59544-00 - Cable and Wire, Electrical (Power, Fixed
Installation).

2. National Codes:

- a. American Institute of Architects (AIA): Guidelines for
Healthcare Facilities.

- b. American National Standards Institute/Electronic Industries Association/Telecommunications Industry Association (ANSI/EIA/TIA):
- 1) 568-C - Commercial Building Telecommunications Wiring Standards:
 - C-1 - General Requirements.
 - C-2 - Balanced twisted-pair cable systems.
 - C-3 - Fiber optic cable systems.
 - 2) 569B - Commercial Building Standard for Telecommunications Pathways and Spaces.
 - 3) 606A - Administration Standard for the Telecommunications Infrastructure of Communications Buildings.
 - 4) 607 - Commercial Building Grounding and Bonding Requirements for Telecommunications.
 - 5) REC 127-49 - Power Supplies.
 - 6) RS 270 - Tools, Crimping, Solderless Wiring Devices, Recommended Procedures for User Certification.
- c. American Society of Mechanical Engineers (ASME):
- Standard 17.4 - Guide for Emergency Personnel.
- Standard 17.5 - Elevator & Escalator Equipment (prohibition of installing non-elevator equipment in Elevator Equipment Room / Mechanical Penthouse).
- d. American Society of Testing Material (ASTM):
- 1) D2301-04 - Standard Specification for Vinyl Chloride Plastic Pressure Sensitive Electrical Insulating Tape.
- e. Building Industries Communications Services Installation (BICSI):
- All standards for smart building wiring, connections and devices for commercial and medical facilities.
- Structured Building Cable Topologies.
- In consort with ANSI/EIA/TIA.
- f. Institute of Electrical and Electronics Engineers (IEEE):
- SO/TR 21730:2007 - Use of mobile wireless communication and computing technology in healthcare facilities - Recommendations for electromagnetic compatibility (management of unintentional electromagnetic interference) with medical devices.
- 0739-5175/08/©2008 IEEE - Medical Grade - Mission Critical - Wireless Networks.

3) C62.41 - Surge Voltages in Low-Voltage AC Power Circuits. g. NFPA:

70 - National Electrical Code (current date of issue) - Articles 517, 645 & 800.

75 - Standard for Protection of Electronic Computer Data-Processing Equipment.

77 - Recommended Practice on Static Electricity.

99 - Healthcare Facilities.

101 - Life Safety Code.

State Hospital Code(s).

Local Town, City and/or County Codes.

Accreditation Organization(s):

- a. Joint Commission on Accreditation of Hospitals Organization (JCAHO) - Section VI, Part 3a - Operating Features.

1.5 QUALIFICATIONS

The OEM shall have had experience with three (3) or more installations of Nurse Call systems of comparable size and interfacing complexity with regards to type and design as specified herein. Each of these installations shall have performed satisfactorily for at least one (1) year after final acceptance by the user. Include the names, locations and point of contact for these installations as a part of the submittal.

The Contractor shall submit certified documentation that they have been an authorized distributor and service organization for the OEM for a minimum of three (3) years. The Contractor shall be authorized by the OEM to pass thru the OEM's warranty of the installed equipment to VA. In addition, the OEM and Contractor shall accept complete responsibility for the design, installation, certification, operation, and physical support for the System. This documentation, along with the System Contractor and OEM certifications must be provided in writing as part of the Contractor's Technical submittal.

The Contractor's Communications Technicians assigned to the System shall be fully trained, qualified, and certified by the OEM on the engineering, installation, operation, and testing of the System. The Contractor shall provide formal written evidence of current OEM certification(s) for the installer(s) as a part of the submittal or to the RE before being allowed to commence work on the System.

The Contractor shall display all applicable national, state and local licenses.

The Contractor shall submit copy (s) of Certificate of successful completion of OEM's installation/training school for installing technicians of the System's Nurse Call and/or Code Blue equipment being proposed.

1.6 CODES AND PERMITS

Provide all necessary permits and schedule all inspections as identified in the contract's milestone chart, so that the system is proof of performance tested, certified and approved by VA and ready for operation on a date directed by the Owner.

The contractor is responsible to adhere to all codes described herein and associated contractual, state and local codes.

1.7 SCHEDULING

After the award of contract, the Contractor shall prepare a detailed schedule (aka milestone chart) using "Microsoft Project" software or equivalent. The Contractor Project Schedule (CPS) shall indicate detailed activities for the projected life of the project. The CPS shall consist of detailed activities and their restraining relationships. It will also detail manpower usage throughout the project.

It is the responsibility of the Contractor to coordinate all work with the other trades for scheduling, rough-in, and finishing all work specified. The owner will not be liable for any additional costs due to missed dates or poor coordination of the supplying contractor with other trades.

1.8 REVIEW OF CONTRACT DRAWINGS AND EQUIPMENT DATA SUBMITTALS (AKA TECHNICAL SUBMITTAL[S])

(Note: The Contractor is encouraged, but not required, to submit separate technical submittal(s) outlining alternate technical approach(s) to the system requirements stated here-in as long as each alternate technical document(s) is complete, separate, and submitted in precisely the same manner as outlined herein. VA will review and rate each received alternate submittal, which follows this requirement, in exactly the same procedure as outlined herein. Partial, add-on, or addenda type alternates will not be accepted or reviewed.)

A. Submit at one time within 10 days of contract awarding, drawings and product data on all proposed equipment and system. Check for

compliance with contract documents and certify compliance with Contractor's "APPROVED" stamp and signature.

Support all submittals with descriptive materials, i.e., catalog sheets, product data sheets, diagrams, and charts published by the manufacturer. These materials shall show conformance to specification and drawing requirements.

Where multiple products are listed on a single cut-sheet, circle or highlight the one that you propose to use. Provide a complete and thorough equipment list of equipment expected to be installed in the system, with spares, as a part of the submittal. Special Communications (TVE-0050P3B) will not review any submittal that does not have this list.

Provide four (4) copies to the COTR for technical review. The COTR will provide a copy to the offices identified in Paragraph 1.3.C & D, at a minimum for compliance review as described herein where each responsible individual(s) shall respond to the COTR within 10 days of receipt of their acceptance or rejection of the submittal(s).

Provide interconnection methods, conduit (where not already installed), junction boxes (J-Boxes), cable, interface fixtures and equipment lists for the: ENR(s) (aka DMARC), TER, TCR, MCR, MCOR, PCR, ECR, Stacked Telecommunications Rooms (STR), Nurses Stations (NS), Head End Room (HER), Head End Cabinet (HEC), Head End Interface Cabinet (HEIC) and approved TCO locations TIP interface distribution layout drawing, as they are to be installed and interconnected to teach other (REFER TO APPENDIX B - SUGGESTED TELECOMMUNI-CAITONS ONE LINE TOPOLOGY pull-out drawing).

Equipment technical literature detailing the electrical and technical characteristics of each item of equipment to be furnished.

Engineering drawings of the System, showing calculated of expected signal levels at the headend input and output, each input and output distribution point, and signal level at each telecommunications outlet.

Surveys Required as a Part of The Technical Submittal:

1. The Contractor shall provide the following System surveys that depict various system features and capacities required **in addition to** the on-site survey requirements described herein (***see Specification Paragraph 2.4.3***). Each survey shall be in writing and contain the following information (the formats are suggestions and

may be used for the initial Technical Submittal Survey requirements), as a minimum:

a. Nurse Call Cable System Design Plan:

An OEM and contractor designed functioning Nurse Call System cable plan to populate the entire TIP empty conduit/pathway distribution systems provided as a part of Specification 27 11 00 shall be provided as a part of the technical proposal. A specific functioning Nurse Call: cable, interfaces, J-boxes and back boxes shall coincide with the total growth items as described herein. It is the Contractor's responsibility to provide the Systems' entire Nurse Call cable and accessory requirements and engineer a functioning Nurse Call distribution system and equipment requirement plan of the following paragraph(s), at a minimum:

The required Nurse Call and/or Code Blue Equipment Locations:

EQUIPPED ITEM	CAPACITY	GROWTH
Master Stations		
Dome Lights		
Room		
Corridor		
Other		
Patient Stations		
Single		
Dual		
Isolation		
Other		
Emergency Stations		
Bath		
Toilet		
Isolation		
Other		
Staff Stations		
Duty Stations		
Code Blue		
Patient Locations		
Surgical Recovery Locations		

Medical Recovery Locations		
ICU Locations		
SICU		
MICU		
CCU		
Other		
Emergency Room Locations		
Other		
Supervisory Locations		
Nurse Stations		
On-Call Rooms		
Other		
Remote Locations		
Telephone Operator's Room		
Police Control Room		
Other		
Radio Paging Access (when pre-approved by TVE-0050P3B)		
Audio Paging Access (when pre-approved by TVE-0050P3B)		
Wireless Access (when pre-approved by TVE-0050P3B)		
Maintenance/Programming Console		
Location(s)		
Central Control Cabinet/Equipment		
Location		
Power Supply(s)		
UPS(s)		

3) The required Nurse Call and/or Code Blue Cable Plant/Connections:

The Contractor shall clearly and fully indicate this category for each item identified herein as a part of the technical submittal. For this purpose, the following definitions and sample connections are provided to detail the system's capability:

EQUIPPED ITEM	CAPACITY	GROWTH
Central Control Cabinet/Equipment		
Location		
Power Supply(s)		
UPS(s)		
Essential Electrical Power Panel(s)		
Other		
Cable Plant		
Supply to Locations Identified in Paragraph 1.8.H.1.a.2)		
Remote Locations		
Telephone Operator Room		
Police Control Room		
Other		
Maintenance/Program Console		
Location(s)		
Other		
LAN (Local Facility) Access/Equipment/Location (when pre-approved by TVE-0050P3B)		
Wireless Access/Equipment/Location (when pre-approved by TVE-0050P3B)		
PA Access/Equipment/Location (when pre-approved by TVE-0050P3B)		
Other		

1.9 PROJECT RECORD DOCUMENTS (AS BUILTS)

Throughout progress of the Work, maintain an accurate record of changes in Contract Documents. Upon completion of Work, transfer recorded changes to a set of Project Record Documents.

The floorplans shall be marked in pen to include the following:

Each device specific locations with UL labels affixed.

Conduit locations.

Each interface and equipment specific location.

Head-end equipment and specific location.

Wiring diagram.

Labeling and administration documentation.

Warranty certificate.

System test results.

1.10 WARRANTIES / GUARANTY

The Contractor shall warrant the installation to be free from defect in material and workmanship for a period of two (2) years from the date of acceptance of the project by the owner. The Contractor shall agree to remedy covered defects within four (4) hours of notification of major failures or within twenty-four (24) hours of notification for individual station related problems.

The Contractor shall agree to grantee the system according to the guidelines outlined in Article 4 herein.

1.11 USE OF THE SITE

Use of the site shall be at the GC's direction.

Coordinate with the GC for lay-down areas for product storage and administration areas.

Coordinate work with the GC and their sub-contractors.

Access to buildings wherein the work is performed shall be directed by the GC.

1.12 DELIVERY, STORAGE, AND HANDLING

Deliver, store, and handle products using means and methods that will prevent damage, deterioration, and loss, including theft.

Store products in original containers.

Coordinate with the GC for product storage. There may be little or no storage space available on site. Plan to potentially store materials off site.

Do not install damaged products. Remove damaged products from the site and replaced with new product at no cost to the Owner.

1.13 PROJECT CLOSE-OUT

Prior to final inspection and acceptance of the work, remove all debris, rubbish, waste material, tools, construction equipment, machinery and surplus materials from the project site and thoroughly clean your work area.

Before the project closeout date, the Contractor shall submit:

OEM Equipment Warranty Certificates.

Evidence of compliance with requirements of governing authorities such as the Low Voltage Certificate of Inspection.

Project record documents.

Instruction manuals and software that is a part of the system.

System Guaranty Certificate.

- C. Contractor shall submit written notice that:
- Contract Documents have been reviewed.
 - Project has been inspected for compliance with contract.
 - Work has been completed in accordance with the contract.

PART 2 - PRODUCTS / FUNCTIONAL REQUIREMENTS

2.0 GENERAL REQUIREMENTS FOR EQUIPMENT AND MATERIALS

Furnish and install a complete and fully functional and operable Nurse Call System for each location shown on the contract drawings and TCOs **WHOSE EMPTY CONDUIT SYSTEM WAS PROVIDED AS A PART OF SPECIFICATION 27 11 00.**

The specific location for each Nurse Call: Central Control Cabinet is ME 200, Power Supply is ME 200, Electrical Supervisor Panel is ME 200, UPS is ME 200, Two (2) Remote Annunciation Consoles, location to be determined by COTR, Master Station is Home Office 120, Duty Station is Home Office 220, Staff Station is Kitchen 103/Kitchen 203, Emergency Station is none, Dome Light is above each door, Code Blue Station is none, and TCOs are each room (list locations here AND indicate like locations on the contract drawings).

Coordinate features and select interface components to form an integrated Nurse Call system. Match components and interconnections between the systems for optimum performance of specified functions. Expansion Capability: The Nurse Call equipment interfaces and cables shall be able to increase number of enunciation points in the future by a minimum of 50 percent (%) above those indicated without adding any internal or external components or main trunk cable conductors.

Equipment: Active electronic type shall use solid-state components, fully rated for continuous duty unless otherwise indicated. Select equipment for normal operation on input power usually supplied between 110 to 130 VAC, 60 Hz supplied from the Facility's Emergency Electrical Power System.

Meet all FCC requirements regarding equipment listing, low radiation and/or interference of RF signal(s). The system shall be designed to prevent direct pickup of signals from within and outside the building structure.

Weather/Water Proof Equipment: Listed and labeled by an OSHA certified NRTL (i.e. UL) for duty outdoors or in damp locations.

2.1 SYSTEM DESCRIPTION

Furnish and install a complete and fully functional and operable Nurse Call and/or Code Blue System **WHOSE EMPTY CONDUIT SYSTEM WAS PROVIDED AS A PART OF SPECIFICATION 27 11 00.**

The Contractor is responsible for interfacing the, MATV, Patient Bed Service Walls and systems with the System.

The Contractor shall continually employ interfacing methods that are approved by the OEM and VA. At a minimum, an acceptable interfacing method requires not only a physical and mechanical connection, but also a matching of signal, voltage, and processing levels with regard to signal quality and impedance. The interface point must adhere to all standards described herein for the full separation of Critical Care and Life Safety systems.

The System Contractor shall connect the System ensuring that all NFPA and UL Critical Care and Life Safety Circuit and System separation guidelines are satisfied. The System Contractor is not allowed to make any connections to the Telephone System. VA shall arrange for the interconnection between the PA, RED and other Systems with the appropriate responsible parties.

System hardware shall consist of a **standalone (separate)** nurse call Code Blue patient communications network comprised of nurse consoles, control stations, staff and duty stations, room and corridor dome lights, pillow speakers/call cords, pull cord and/or emergency push button stations, wiring. And, other options such as, **pocket page interfaces**, computer interfaces, printer interfaces, wireless / telephone network interfaces, and nurse locating system interface **(when specifically approved first by TVE 0050P3B)** and as shown on drawings. All necessary equipment required to meet the intent of these specifications, whether or not enumerated within these specifications, shall be supplied and installed to provide a complete and operating nurse call Code Blue patient communications network. ***It is not acceptable to utilize the telephone cable system for the control and distribution of nurse call (code Blue) signals and equipment.***

System firmware shall be the product of a reputable firmware OEM of record with a proven history of product reliability and sole control over all source code. Manufacturer shall provide, free of charge, product firmware/software upgrades for a period of two (2) years from date of acceptance by VA for any product feature enhancements. System

configuration programming changes shall not require any exchange of parts and shall be capable of being executed remotely via a modem connection (when specifically approved first by TVE 0050P3B).

The Nurse Call Head End Equipment shall be located in Telecommunications Room ME 200. The Nurse Call / Code Blue System may interface the PA system when specifically approved by VA Headquarters TVE 0050P3B during the project approval process prior to contract bidding.

The System shall utilize microprocessor components for all signaling and programming circuits and functions. Self contained or on board system program memory shall be non-volatile and protected from erasure from power outages for a minimum of 12 hours.

Provide a backup battery or a UPS for the System (including each distribution cabinet/point, CRT and Monitor) to allow normal operation and function (as if there was no AC power failure) in the event of an AC power failure or during input power fluctuations for a minimum of 30 minutes.

The System is defined as Critical Service and the Code Blue functions is defined as Life Safety/Support by NFPA (re Part 1.1.A) and so evaluated by JCAHCO. Therefore, the system shall have a minimum of two (2) additional remote enunciation points in order to satisfy NFPA's Life Safety Code 101 (the typical secondary locations are Telephone Operators Room, MAS ER Desk, Boiler Plant, etc; AND the primary location is required to be in the SCC Room.

1. These two (2) additional remote locations shall be fully manned: 24/7/365 for certified Hospital.

As long as other identified VA Medical / Servicing Facilities are open for servicing patients.

At a minimum, Code Blue Functions shall be provided in all Recovery (Medical and Surgical) Rooms, Intensive Care Units (ICU), Cardiac Care Units (CCU), Step Down Room, Life Support / Monitoring Rooms, Oncology / Radiology Procedure Rooms, Dialysis Areas.

The minimum remote enunciation locations shall be:

The Telephone / PBX Operator Room.

The Police Control / Operations Room.

- 3) Other location(s) that is specifically approved by VA Headquarters TVE - 0050P3B DURING THE PROJECT DEVELOPMENT STAGES AND PRIOR TO EQUIPMENT PURCHASE.
2. In addition to the two (2) remote locations afore described, the following locations are the minimum required for additional Nurse Call /Code Blue Annunciation:
 - "On Call" Rooms.
 - Each Nurse Master Station.
 - Each Staff Station.
 - Each Duty Station.
3. The MAXIMUM enunciation time period from placement of the Code Blue Call to enunciation at each remote locations is 10 seconds; and, 15 seconds to the subsequent enunciating media stations (i.e. PA, Radio Paging, Emergency Telephone or Radio Backup, etc.).

Each Code Blue System shall be designed to provide continuous electrical supervision of the complete and entire system (i.e. dome light bulbs [each light will be considered supervised if they use any one or a combination of (UL) approved electrical supervision alternates, as identified in UL-1069, 1992 revision], wires, contact switch connections, circuit boards, data, audio, and communication busses, main and UPS power, etc.). All alarm initiating and signaling circuits shall be supervised for open circuits, short circuits, and system grounds. Main and UPS power circuits shall be supervised for a change in state (i.e. primary to backup, low battery, UPS on line, etc.). When an open, short or ground occurs in any system circuit, an audible and visual fault alarm signal shall be initiated at the nurse control station and all remote locations.

When the System is approved to connect to a separate communications system (i.e. LAN, WAN, Telephone, Public Address, radio raging, wireless systems, etc) the connection point shall meet the following minimum requirements for each hard wired / wireless connection (note each wireless system connection MUST BE APPROVED PRIOR TO CONTRACT BID BY VA HEADQUARTERS TVE - 0050P3B AND SPECTRUM MANAGEMENT - 0050P2B - hereinafter referred to as SM - 0050P2B):

UL 60950-1/2.

FIPS 142.

FCC Part 15 Listed Radio Equipment restriction compliance approved by SM - 0050P2B.

All passive distribution equipment shall meet or exceed -80 dB radiation shielding (aka RFI) shielding specifications and be provided with connectors specified by the OEM.

All equipment face plates utilized in the system shall be stainless steel, anodized aluminum or UL approved cyclac plastic for the areas where provided.

Noise filters and surge protectors shall be provided for each equipment interface cabinet, headend cabinet, control console and local and remote amplifier locations to insure protection from input primary AC power surges and to insure noise glitches are not induced into low voltage data circuits.

Plug-in connectors shall be provided to connect all equipment, except coaxial cables. Coaxial cable distribution points shall use coaxial cable connections recommended by the cable OEM and approved by the system OEM. Base band cable systems shall utilize barrier terminal screw type connectors, at a minimum. As an alternate, crimp type connectors installed with a ratchet type installation tool are acceptable provided the cable dress, pairs, shielding, grounding, connections and labeling are the same as the barrier terminal strip connectors. Tape of any type, wire nuts or solder type connections are unacceptable and will not be approved.

R. Audio Level Processing: The control equipment shall consist of audio mixer(s), volume limiter(s) and/or compressor(s), and power amplifier(s) to process, adjust, equalize, isolate, filter, and amplify each audio channel for each sub-zone in the system and distribute them into the System's RF interfacing distribution trunks and amplification circuits. It is acceptable to use identified Telephone System cable pairs designated for Two-Way Radio interface and control use or identified as spare telephone cable pairs by the Facility's Telephone System Contractor. The use of telephone cable to distribute RF signals, carrying system or sub-system AC or DC voltage is not acceptable and will not be approved. Additionally, each control location shall be provided with the equipment required to insure the system can produce its designed audio channel capacity at each speaker identified on the contract drawings. The Contractor shall provide: a spare set of telephone paging modules as recommended by the OEM (as a minimum provide one spare module for each installed module); one spare audio power amplifier, one spare audio mixer, one spare audio volume limiter

and/or compressor, and one spare audio automatic gain adjusting device, and minimum RF equipment recommended by the OEM.

S. Contractor is responsible for pricing all accessories and miscellaneous equipment required to form a complete and operating system. Unless otherwise noted in this Part, equipment quantities shall be as indicated on the drawings.

R. System Performance:

1. At a minimum, each distribution, interconnection, interface, terminating point and TCO shall be capable of supporting the Facility's Nurse Call and/or Code Blue System voice and data service as follows:

Shall be compliant with and not degrade the operating parameters of the Public Switched Telephone Network (PSTN) and the Federal Telecommunications System (FTS) at each PSTN and FTS interface (if attachment is permitted by TVE 005OP3B), interconnection and TCO terminating locations detailed on the contract drawings.

The System shall provide the following minimum operational functions:

Code Blue calls shall be cancelable at the calling station only. The nurse call master station (s) that a managing Code Blue functions shall not have the ability to cancel Code Blue calls.

Each Code Blue system shall be able to receive audio calls from all bedside stations simultaneously.

Calls placed from any Code Blue station shall generate Code Blue emergency type audible and visual signals at each associated nurse control and duty station, respective dome lights and all local and remote annunciator panels. Calls placed from a bedside station shall generate emergency type visual signals at the bedside station and associated dome light(s) in addition to the previous stated stations and panels.

Activating the silencing device at any location, while a Code Blue call or system fault is occurring shall mute the audible signals at the alarm location.

a) The audible alarm shall regenerate at the end of the selected time-out period until the call or fault is corrected.

The visual signals shall continue until the call is canceled and/or a fault is corrected. When the fault is corrected, all signals generated by the fault shall automatically cease, returning the System to a standby status.

Audible signals shall be regenerated in any local or remote annunciator panel that is in the silence mode, in the event an additional Code Blue call is placed in any Code Blue system.

The additional Code Blue call shall also generate visual signals at all annunciators to identify the location of the call. 2. Each System Nurse Call location shall generate a minimum of distinct calls:

Routine: single flashing dome lights & master station color and audio tone,

Staff Assist: rapid flashing dome lights & master station color and audio tone,

Emergency: Red flashing dome lights & master station color and audio tone,

Code Blue (if equipped): Blue flashing dome lights and master station color and audio tone,

Each generated call shall be cancelable at ONLY the originating location,

Staff Locator: Green Flashing dome lights & master station color and audio tone, and

2.3 MANUFACTURERS

- A. The products specified shall be new, FCC and UL Listed, labeled and produced by OEM manufacturer of record. An OEM of record shall be defined as a company whose main occupation is the manufacture for sale of the items of equipment supplied and which:

Maintains a stock of replacement parts for the item submitted,
 Maintains engineering drawings, specifications, and operating manuals for the items submitted, and

Has published and distributed descriptive literature and equipment specifications on the items of equipment submitted at least 30 days prior to the Invitation for Bid.

Specifications contained herein as set forth in this document detail the salient operating and performance characteristics of equipment in order for VA to distinguish acceptable items of equipment from unacceptable items of equipment. When an item of equipment is offered or furnished for which there is a specification contained herein, the item of equipment offered or furnished shall meet or exceed the specification for that item of equipment.

Equipment Standards and Testing:

The System has been defined herein as connected to systems identified as Critical Service performing various Emergency and Life Support Functions. Therefore, at a minimum, the system shall conform to all aforementioned National and/or Local Life Safety Codes (which ever are the more stringent), NFPA, NEC, this specification, JCAHCO Life Safety Accreditation requirements, and the OEM recommendations, instructions, and guidelines.

All supplies and materials shall be listed, labeled or certified by UL or a NRTL where such standards have been established for the supplies, materials or equipment.

The provided equipment required by the System design and approved technical submittal must conform with each UL standard in effect for the equipment, as of the date of the technical submittal (or the date when the RE approved system equipment necessary to be replaced) was technically reviewed and approved by VA. Where a UL standard is in existence for equipment to be used in completion of this contract, the equipment must bear the approved UL seal.

Each item of electronic equipment to be provided under this contract must bear the approved UL seal or the seal of the testing laboratory that warrants the equipment has been tested in accordance with, and conforms to the specified standards. The placement of the UL Seal shall be a permanent part of the electronic equipment that is not capable of being transportable from one equipment item to another.

2.4 PRODUCTS

A. General.

1. Contractor is responsible for pricing all accessories and miscellaneous equipment required to form a complete and operating system. The equipment quantities provided herein shall be as indicated on the drawings with the exception of the indicated spare equipment.

2. Contractor Furnished Equipment List (CFEs):

- a. The Contractor is required to provide a list of the CFE equipment to be furnished. The quantity, make and model number of each item is ~~required that~~ Select the required equipment items quantities ~~required that~~ satisfy the needs of the system as described herein and will with the OEM's concurrence applied to the list(s), in writing.

Item	Quantity	Unit
1.	3	Interface Panel(s)
1.a	3	Electrical Supervision Trouble Enunciator
1.a.1	100	Equipment Back Box(s)
1.b	0	Telephone
1.c	0	Public Address
1.d	0	Radio Paging / Equipment
1.e	0	Wireless / Equipment
1.f.	0	Radio Pager / Equipment
1.g	0	Wireless / Equipment
1.f	0	Personal Communicator / Equipment
2.	0	Lightning Arrestor
3.	3	Head End Equipment/Locations
3.a	0	Cabinet(s)
3.a.1	3	AC Power Conditioner & Filter
3.a.2	3	AC Power Strip
3.a.3	0	UPS
3.a.4	100	Interconnecting Wire/Cables
3.a.5	100	Wire / Cable Connector(s)
3.a.6	100	Wire / Cable Terminator(s)
3.b	0	Wire Management System
3.b	3	Head End Function(s)
3.b.1	3	H7 Interface
3.b.2	3	Nurse Locator
3.b.3	3	Staff Locator
4.	3	Master Station(s)
4.a	3	Nurse Locator
4.b	3	Staff Locator
5.	3	Distribution System(s)
5.a	5	Staff Station
5.a.1	5	Equipment Back Box(s)
5.b	4	Duty Station
5.b.1	4	Equipment Back Box(s)
5.c	2	Code Blue Station
5.c.1	2	Equipment Back Box(s)
5.c.2	2 (MIN)	Remote Station(s)
5.d	100	Patient Station(s)
5.d.1	100	Equipment Back Box(s)
5.d.2	100	Bed Interface(s)
5.d.3	100	Pillow Speaker
5.d.4	100	Push Button Cordset
5.d.5	25	Dummy Plugs
5.d.6	100	Bed Integrated Control
5.d.7	3	Lighting Interface Module
5.d.8	100	TV Control Interface

5.d.9	100	TV Control Jack
5.d.10	3	TV Interconnection Cables
5.d.11	3	HDTV Coaxial
5.d.12	3	HDTV/Nurses Call Interface/ Control
5.d.13	3	Auxiliary Mounting Interface
5.e	2	Emergency Station(s)
5.e.1	2	Equipment Back Box(s)
5.e.2	50	Toilet Emergency Station (waterproof)
5.e.3	50	Shower Emergency Station (waterproof)
5.e.4	50	Lavatory Emergency Station (waterproof)
5.f.	100	Room Dome Light
5.f.1	100	Equipment Back Box(s)
5.g	0	Other Dome Light(s)
5.g.1	0	Equipment Back Box(s)
5.g.2	100	Corridor Dome Light
5.g.3	0	Intersectional Dome Light
5.h	100	System Cable(s)
5.h.1	0	Coaxial
5.h.2	3	System Pin
5.h.3	0	Audio
5.h.4	3	Control
5.h.5	0	Video
5.i	3	System Connector(s)
5.i.1	0	Coaxial
5.i.2	3	System Pin
5.i.2	3	Audio
5.i.3	3	Control
5.i.4	3	Video
5.j	3	Wire Management Required as described herein

NS Room(s):

Refer to CFM Physical Security Manual (07-2007) for VA Facilities, Chapters 9.3 & 1) and PG 18-10, EDM, Chapters 7- Table 7-1, 8 & Appendix B, Telecommunications One Line Topology for specific Room and TIP Connection Requirements.

TER, SCC, PCR, STR, HER Rooms and Equipment:

Refer to CFM Physical Security Manual (07-2007) for VA Facilities, Chapters 9.3 & 1) and PG 18-10, EDM, Chapters 7- Table 7-1, 8 & Appendix B, Telecommunications One Line Topology for specific Room and TIP Connection Requirements.

Telecommunications Room(s) (TR):

Locate the Nurse Call and/or Code Blue floor distribution equipment as required by system design and OEM direction. Provide secured and lockable cabinet/rack(s) as required.

Head-End Equipment:

Provide all required power supplies, communications hubs, network switches, intelligent controllers and other devices necessary to form a complete system. Head-end components may be rack mounted or wall mounted in an enclosed metal enclosure.

Provide the head end equipment in the closest Telecommunications Room where the System is installed.

Provide the System UPS inside the cabinet or in a separate cabinet adjacent to the head end cabinet that shall maintain a minimum of 30 minute battery back-up to all system components.

Equipment Cabinet: Comply with TIA/EIA-310-D. Lockable, ventilated metal cabinet houses terminal strips, power supplies, amplifiers, system volume control, and other switching and control devices required for conversation channels and control functions. See Paragraph 2.5.E for the Cabinet's minimum internal items that are in addition to the installed System equipment.

Vertical Equipment Rack, Wall Mounted (to be included inside of the Equipment Cabinet) containing the following minimum items:

36" (28RU) internal rack space, welded steel construction, minimum 20" usable depth, adjustable front mounting rails.

Install the following products in rack provided by same manufacturer or as specified:

Security screws w/ nylon isolation bushings.

Textured blank panels.

Custom mounts for components without rack mount kits.

Security covers.

Internal system ground copper buss (may be substituted with a bare #0 AWG copper wire or equivalent size copper mesh strip connected to ONLY THE FACILITY'S SIGNAL GROUNDING SYSTEM).

Power Sequencer- rack-mounted power conditioner and (provide as-needed) delayed sequencer(s) with (2) unswitched outlets each and contact closure control inputs. Connect the conditioner to one of the dual duplex outlets.

Two (2) each 120VAC @ 20A dual duplex outlets, connected via conduit to the nearest Electrical Service Panel that is supplied by the Facility's Essential Electrical System.

One (1) each 120VAC @ 15A Power Distribution Strip(s).

Connect each strip to the unstitched outlet on the power conditioner.

3. HL7 Interface:

The system may support downloading and updating of patient data from the hospital admission system (or other database) via the HL7 standard. The data only has to travel one way, i.e. from the admission system to the nurse-call system.

Coordinate with the Owner the exact fields that will be populated from the admissions system in the nurse-call system.

The Facility's LAN/WAN is not allowed for Nurses Call/Code Blue main wiring / function that must be a "stand alone primary cable infrastructure" as described herein.

Connections to the VA LAN/WAN for functional or operable conditions will be allowed ONLY when the LAN/WAN system has been demonstrated and NFPA (at a minimum by TVE-0050P3B) Certified meeting Life Safety Standards.

Provide one (1) spare HL Interface unit.

4. Wireless:

a. Radio Paging Equipment / Systems

- 1) The nurse call/code blue system shall have the ability to interface ONLY with VA Certified and Licensed radio paging system (FCC Part 15 listed pagers and transmitters are not allowed for "Safety of Life" functions or installed in those specific areas - VA Headquarters TVE - 0050PB2 and SM - 0050PB2 are the ONLY approving authorities for this function) and must have the following minimum system features:

Ability to pass-through location information (such as a room number) and call-type as well as other text messages simultaneously to shift supervisor identified staff members
System shall allow the operator to select staff members by name and pager number and to select a message consisting of a room number and a condition code (aka priority level).
Operator may also choose to type in a unique alpha-numeric text message (the text message shall meet or exceed all

HIPA and VA OCIS Communications Security Guidelines for the transmission of Patient or Staff Specific information [aka PII] - VA Headquarters TVE - 0050P2B is the approving authority for this function) into the system to be read by the holder of the pager unit.

While a patient station is connected to the nurse's master station, the system shall allow the operator to automatically page the staff member assigned to that room. An alternate staff member may be selected for paging purposes in place of the primary staff member. The System must allow an alternate staff member to be paged when the primary staff member is unable to respond to patient's needs within a specified period of time. The System must have the ability to assign any bed to any pager or pager group, and to assign an unlimited amount of pagers to any patient bed.

System shall have the ability to send all code blue calls to staff members by predetermined group (as required) automatically by simply pressing one "Code Blue" button. Pager shall indicate room number of code call, and state "Code Blue" in plain English format on pagers (*FCC Part 15 listed pagers are not allowed to be use as "Safety of Life" functions or those specific locations - VA Headquarters TVE - 0050P2B is the approving authority for this requirement*).
2) When pagers are approved, provide a minimum of ten (10) spare pagers with one spare pager for each 10 issued.

5. Personal Wireless Communicator

The System will only be allowed to connect to the personal wireless communications system, pass text data and provide a 2-way communication between the Telephone Interface and the personal wireless communicator as long as it is not a FCC Part 15 listed device(s), meets or exceeds UL 60950-1/2, meets OCIS Guide Lines for FIPS 140-2 certification and the using staff shows an extensive training program along with recertification(s) according to the Facility Emergency Plan concerning HIPA requirements.

VA Headquarters TVE - 0050P3B and SM - 0050P2B are the approving authority for this requirement.

c. When communicators are approved, provide a minimum of ten (10) spare communicators for each 10 communicators issued.

6. Other Wireless Equipment / Systems

Each proposed wireless system and/or equipment to be connected to or be a part of the System, each shall meet the minimum requirements outlines in Paragraph 2.7.A.

Contact TVE - 0050P3B and SM - 0050P2B for specific required PRE approvals (full or conditional) as described herein.

When approved, TVE-0050P3B and SM-0050P2B will provide the spare equipment requirements.

When other wireless components are approved, provide ten (10) components with one spare components for each 10 issued.

TIP Cable Systems:

Connect the system to the TIP system provided as a part of Speciation Section 27 15 00. Provide additional TIP equipment, interfaces and connections as required by System design. Provide secured pathway(s) and lockable cabinet/rack(s) as required.

Interface Equipment: 1.

TCR:

a. Code Blue Annunciation Station:

The Code Blue Remote Annunciation Station shall be located in the Telephone Operators Room or Police Control Center.

The Annunciation Station shall be connected to the System via hard wire connection(s) that shall contain all the electrical supervisory tone signals, visual bulbs, read out panel to indicate the location of the Code and system troubles.

The System shall not be connected to the Telephone system unless specifically APPROVED BY VA HEADQUARTERS (0050P3B) and (0050P2B) PRIOR TO CONTRACT BID.

The Annunciation Station shall be installed in a location directly viewable and the readout is completely readable from the Public Address Microphone Control Console.

Provide one (1) spare panel.

b. Electrical Supervision Trouble Annunciator Panel:

1) The Electrical Supervision Trouble Annunciation Panel shall be located in the Telephone Operators Room, Police Control Center, and ME 200.

The panel(s) shall be compatible with the generated electrical and/or electronic supervising signals to continuously monitor the operating condition for the System head-end processing equipment, master stations, staff stations, patient stations, duty stations, audio power amplifier(s), UPS, power supplies, dome lights and interconnecting trunks. The panels shall generate an audible and visual signal when the System's supervising system detects a system and equipment trouble or trunk-line is malfunctioning.

Provide one (1) spare panel.

2. Hospital Bed Interface (s):

- a. Provide a multi-pin receptacle for bed connection.
- b. Connect cable from the multi-pin receptacle to the nurse-call system, so that alarms, such as bed exit, shall be monitored by the nurse-call system.
- c. Connect cable from the multi-pin receptacle to the nurse-call system, so that the bedside control buttons, such as nurse call, and television controls are functional and monitored.
- d. The hospital uses the following beds:
 - Hill Rohm
 - Stryker
 - Verify with COTR
- e. Provide one (1) spare interface for each ten (10) interfaces installed.

3. Nurse (aka Staff) Locator Interface:

The System must be capable of performing nurse-locator functions. The System must be capable of performing staff-locator functions. These functions may be combined into one operation. Provide two (2) spare interfaces.

4. Lighting Interface Module:

Provide an interface module for the pillow speakers to control up to 2 lights. Coordinate with the electrical contractor the exact voltage requirements.

Provide one (1) spare module for each ten (10) modules installed.

5. Pillow Speaker Interfaces:

See functional requirements herein.

Provide (2) pillow speaker for each patient station.

- c. Provide one (1) spare pillow speaker for each twenty (20) speakers installed.
- 6. TV Remote Control Interface:
 - a. The pillow speaker shall have the following TV control capability:
 - Play the TV audio through the pillow speaker.
 - Change channels up and down.
 - Increase and decrease the volume.
 - TV audio mute.
 - UL Certified for direct patient contact.
 - b. Provide one (1) spare interface for each 20 interfaces installed.
- 7. TV Control Jack and Wiring:
 - Provide connection from the pillow speaker to the TV location.
 - Terminate wire on a jack in the TV low voltage faceplate.
 - Coordinate faceplate opening with the cabling contractor.
 - Coordinate jack type with the TV (typically it is a 1/4" jack, but verify prior to installation).
 - Provide patch cord from the TV control jack to the TV.
 - Provide one (1) spare complete assembly for each twenty (20) assemblies installed.
- 8. Additional Functions / Interfaces:
 - The nurse-call system may perform additional services/ functions when specifically approved by TVE-0050P3B during the project design phases and prior to the bid process.
- 9. TER
 - a. Paging adaptor (When connections are specifically approved by TVE 0050P3B):
 - The Contractor shall coordinate the installation of the paging adapter(s) designed for use with the Facility's telephone system with the Facility Telephone Contractor or local telephone company.
 - The Contractor shall provide and install a paging adapter(s) for each zone and sub zone. The paging adapter(s) shall be accessible by dialing a telephone number provided by the Facility's Telephone Contractor. The Paging Adapter shall:
 - Monitor each audio input and output on the unit.
 - Be provided with an electrical supervision panel to provide both audio and visual trouble alarms.

Be provided as part of the headend equipment and shall be located in the Telephone Switch Room.

Be provide with Executive Paging Override of all routine paging calls in progress or being accessed to allow system "all call" (aka global) and radio paging calls designated as Code One Blue) functions.

Be capable of internal time out capability.

Function completely with the interface module.

Provide one spare adapter.

3) Time Out Device:

A time out device/capability shall be provided to prevent system "hang-up" due to an off-hook telephone. The device shall be able to be preset from 30 seconds to two (2) minutes. Its function shall not interfere with or override the required "all call" (aka global) operational capability.

H. Call Initiation, Annunciation and Response:

1. Light and Tones:

a Calls may be initiated through:

Patient station.

Staff station.

Code Blue station.

Toilet Emergency Station pull cord / push button.

Shower Emergency Station pull cord.

Bed Pillow speaker.

Bed Push-button cordset.

Hospital Bed Integrated controls.

b Once a call is initiated, it must be annunciated at the following locations:

The Corridor, Intersectional and Room dome light associated with the initiating device.

A local master control station indicating the call location and priority.

Each duty station.

Each staff station.

Each remote location.

c) All calls must be displayed until they are cleared by the nursing staff **ONLY** from the initiating device location.

2. Voice:

a Calls may be initiated through:

Patient station.

Staff station.

Code Blue station.

Toilet Emergency pull cord / push button station.

Shower Emergency pull cord station.

Pillow speaker.

Push-button cordset.

Integrated bed controls.

Master Station.

Provide two-way voice communication between a master station and patient, staff, duty and each of the two (2) remote stations.

Failure of voice intercom portion of system shall not interfere with visual and audible signal systems.

All calls must be displayed on the master station until they are cleared by the nursing staff at ONLY the originating station. If multiple calls are received at the master station within a short period of time, they shall be stacked based on priority and wait time. If there are more calls than the master station screen can display at one time (four [4] minimum), the system must provide a simple scrolling feature. The nurse must be able to answer any call in any order at the master station. The nurse must also be able to forward calls to staff members. If a call is not answered within a programmable time period, then the system must forward the call to appropriate back-up staff identified by each shift supervisor in a manner technically approved by VA Headquarters 0050P3B.

7. Wireless personal communicator (within the restrictions identified herein)

I. Auxiliary Alarm Monitoring:

Each patient station must have the ability to connect a separate and isolated auxiliary alarm to it such as an infusion pump or data tracking / recording device (patient life support units ARE NOT allowed to be connected to these units UNLESS APPROVED BY TVE - 0050P3B DURING THE PROJECT DEVELOPMENT PHASE AS DESCRIBED HEREIN.

The System must support naming the device that is being monitored as well as display its alarms at the master station and via the room / corridor dome light(s).

Provide (2) alarm jacks at each patient station.

3. The above requirements may ONLY be allowed when the system has been approved by VA Headquarters TVE - 0050P3B and TVE - 0050P2B and concurred by the appropriate Medical Service(s) indicates it meets the minimum guidelines and requirements of Paragraph 2.8.A.

J. Patient and Staff Assignment:

1. System may provide for transfer of one or more individual or groups of stations from one master station to another without mechanical switches or additional wiring of the stations. The transfer may be initiated manually by the nurse or automatically at certain times of the day.
2. The Facility's LAN/WAN IS NOT ALLOWED for Nurses Call/Code Blue main wiring which must be a "stand alone primary cable infrastructure."
Connections to the VA LAN/WAN will be allowed ONLY when the LAN/WAN system has been demonstrated and certified by TVE - 0050P3B meeting the minimum guidelines and requirements of the Life Safety Code.

K. Reports:

The system's generated reports logging all calls, alarms, response time, bed, and staff assignments may be allowed to transmit these reports to a central archiving entity.

Reports function shall be limited by passwords and security tier level access, so that only supervisors may access it when desired.

Provide instructions to the owner on how to enable/disable the reporting functions.

The Facility's LAN/WAN IS NOT ALLOWED for Nurses Call/Code Blue main wiring that must be a "stand alone primary cable infrastructure." Connections to the VA LAN/WAN will be allowed ONLY when the system has been demonstrated and certified by 0050P2B meeting the minimum guidelines and requirements of the Life Safety Code.

L. System/Management Software:

1. Provide and install system/management software on minimum of three (3) owner-provided computers.

The management software shall at a minimum provide all historical reporting features of the system as well as real-time monitoring of events.

The system software shall at a minimum provide the system's operating and functioning parameters and script. The OEM shall provide VA with access to the software's script writing and functions.

Provide two (2) spare CD's with the software installed and operable.

Rights in Data: VA shall have the right to all script and programming language of system management software. If commercial off the shelf (COTS) or a memorandum of understanding (MOU) is required for follow-on maintenance, the Contractor is required to accomplish the COTS Survey document and the RE is required to accomplish the COTS Acquisition document supplied in Part 5 Attachments herein.

M. System Functional Station:

1. Master Control:

a. Simple Tone and Light:

A visual / aural (tone only) system shall be provided, protected and located in the Day Hospital, Mental Health & Blind Rehabilitation Areas, OPC where surgery or procedures are not performed. The System shall include a push-button emergency station (pull cord in Day Hospital and pushbutton in Mental Health & Blind Rehabilitation areas) with an associated corridor dome light in each dressing room (OPC) and toilet (OPC, Day Hospital, Mental Health, Blind Rehabilitation.

The visual / aural (tone only) system shall also include a power supply and a visual / aural (tone only) display panel in the Home Office area and as shown on the drawings. The visual / tone display panel shall generate audible and visual emergency signals to indicate the location of a placed call.

The Visual Display Panel shall be a digital readout touch screen to visually announce the location of incoming calls placed in the System including room and bed number and priority of the call. Identify each calling station with an individual display, including separate displays for each patient sharing a dual bedside station. If a digital readout touch screen standard is not required or approved by the Facility during the project design phase, an alpha - numeric scheme shall be provided that identifies the: ward, room and bed (i.e. Ward 2a, Room 201, Bed A (or 1) shall read 2A201A - or- 2A201-1. Equivalent readouts are acceptable as long as TVE 005OP3B and the Facility approve the readout).

a) Calls placed at emergency stations located in toilets and baths inside bedrooms shall be displayed for the bed

closest to the nurse control station. Beds in multi-bed bedrooms shall be identified in a clock-wise pattern upon entering the bedroom.

- b) It shall display a minimum of four incoming calls. Additional placed calls shall be stored in order of placement and priority.

The visual / aural (tone only) system shall be installed according to the same Procedures, guidelines and standards outlined for a regular Nurse Call System for emergency **NOT CODE BLUE OPERATION.**

Speakerphone and handset communication.

Provide one (1) spare station for each ten (1) stations installed. b. Touch Screen:

Provide a touch screen master station with 15" minimum monitor size.

The master station shall have a full control capability over staff assignment to patients and beds as well as pagers and wireless personal communication devices (when specifically approved by 0050P3B on a case by case basis).

Speakerphone and handset communication.

Provide one (1) spare station for each ten (1) stations installed.

2. Staff:

Light and Tone Only.

Voice Communications Enabled.

Provide one (1) spare station for each twenty (20) stations installed.

3. Duty:

Light and Tone Only.

Voice Communications Enabled.

Provide one (1) spare station for each twenty (20) stations installed.

4. Patient:

a. Single & Dual:

1) Provide each patient station with the following minimum Feature.

- a) Call button.

Call answered button.

Pillow speaker jack.

Auxiliary alarm monitoring jack.

Hospital bed interface jack (when specially approved by TVE - 0050P3B).

Provide one (1) spare station for each twenty (20) stations installed.

N. Distribution System: Refer to Specification Sections 27 11 00, Structured TIP Communications Cables; 27 11 00, TIP Communications Interface and Equipment Rooms Fittings and 27 15 00, HORIZONTAL and Vertical TIP Communications Cabling for additional specific TIP wire and cable standards and installation requirements used to install the Facility's TIP network.

1. In addition to the TIP provided under the aforementioned Specification Sections, the contractor shall provide the following additional TIP installation and testing requirements, provide the following minimum additional System TIP requirements, cables & interconnections:

Each wire and cable used in the System shall be specifically OEM certified by tags on each reel and recommended and approved for installation in the Facility.

The Contractor shall provide the RE a 610 mm (2 foot) sample of each wire and/or cable actually employed in the System **and each** certification tag for approval before continuing with the installation as described herein.

Fiberoptic Cables: Refer to Specification Section 27 15 00, Horizontal and Vertical TIP Communications Cabling; Paragraph 2.4.C12.d. Fiberoptic Cables - for minimum technical standards and requirements for additional System cables.

Copper Cables: Refer to Specification Section 27 15 00, Horizontal and Vertical TIP Communications Cabling; Paragraph 2.4.C12.c. Copper Cables - for minimum technical standards and requirements for additional System voice and data cables.

Line Level Audio and Microphone Cable:

Line level audio and microphone cable for inside racks and conduit.

Shielded, twisted pair Minimum 22AWG, stranded conductors and 24AWG drain wire with overall jacket.

f. Speaker Level Audio (70.7Volt RMS):

For use with 70.7V speaker circuits.

18AWG stranded pair, minimum.

g. All cabling shall be plenum rated.

h. Provide one (1) spare 1,000 foot roll of approved System (not microphone) cable only.

2. Raceways, Back Boxes and conduit:

In addition to the Raceways, Equipment Room Fittings provided under Specification Sections 27 15 00 TIP Communication Room Fittings and 27 15 00 - TIP Communications Horizontal and Vertical Cabling, provide the following additional TIP raceway and fittings:

Each raceway that is open top, shall be: UL certified for telecommunications systems, partitioned with metal partitions in order to comply with NEC Parts 517 & 800 to "mechanically separate telecommunications systems of different service, protect the installed cables from falling out when vertically mounted and allow junction boxes to be attached to the side to interface "drop" type conduit cable feeds.

Intercommunication System cable infrastructure: EMT or in J-hooks above accessible ceilings, 24 inches on center.

Junction boxes shall be not less than 2-1/2 inches deep and 6 inches wide by 6 inches long.

Flexible metal conduit is prohibited unless specifically approved by 0050P3B.

System Conduit:

The PA system is NFPA listed as Emergency / Public Safety Communication System which requires the entire system to be installed in a separate conduit system.

The use of centralized mechanically partitioned wireways may be used to augment main distribution conduit on a case by case basis when specifically approved by VA Headquarters (0050P3B).

Conduit Sleeves:

- a) The AE has made a good effort to identify where conduit sleeves through full-height and fire rated walls on the drawings, and has instructed the electrician to provide the sleeves as shown on the drawings.

b) While the sleeves shown on the drawings will be provided by others, the contractor is responsible for installing conduit sleeves and fire-proofing where necessary. It is often the case, that due to field conditions, the nurse-call cable may have to be installed through an alternate route. Any conduit sleeves required due to field conditions or those omitted by the engineer shall be provided by the cabling contractor.

g. Device Back Boxes:

Furnish to the electrical contractor all back boxes required for the PA system devices.

The electrical contractor shall install the back boxes as well as the system conduit. Coordinate the delivery of the back boxes with the construction schedule.

3. UPS:

Provide a backup battery or a UPS for the System to allow normal operation and function (as if there was no AC power failure) in the event of an AC power failure or during input power fluctuations for a minimum of 30 minutes.

As an alternate solution, the telephone system UPS may be utilized to meet this requirement at the headend location, as long as this function is specifically approved by the Telephone Contractor and the COTR.

The Nurse Call Contractor shall not make any attachments or connection to the telephone system until specifically directed to do so, in writing, by the COTR.

Provide UPS for all active system components including but not limited to:

System Amplifiers.

Microphone Consoles.

Telephone Interface Units.

TER, TR & Headend Equipment Rack(s).

O. Patient Bedside Prefabricated Units (PBPU):

1. Where PBPU's exist in the Facility; the Contractor shall identify the "gang box" location on the PBPU designated for installation of the telephone jack. This location shall here-in-after be identified as the unit's TCO. The Contractor shall be responsible for obtaining written approval and specific instructions from the PBPU OEM

regarding the necessary disassembly and reassembly of each PBPU to the extent necessary to pull wire from above the TIP ceiling junction box to the PBPU's reserved gang box for the unit's TCO. A Contractor provided stainless steel cover plate approved for use by the PBPU OEM and Facility IRM Chief shall finish out the jack installation.

Under no circumstances shall the Contractor proceed with the PBPU installations without the written approval of the PBPU OEM and the specific instructions regarding the attachment to or modifying of the PBPU. The RE shall be available to assist the Contractor in obtaining approvals and instructions in a timely manner as related to the project's time constraints.

It is the responsibility of the Contractor to maintain the UL integrity of each PBPU. If the Contractor violates that integrity, it shall be the responsibility of the Contractor to obtain on site UL re-certification of the violated PBPU at the direction of the RE and at the Contractor's expense.

P. Installation Kit:

General: The kit shall be provided that, at a minimum, includes all connectors and terminals, labeling systems, audio spade lugs, barrier strips, punch blocks or wire wrap terminals, heat shrink tubing, cable ties, solder, hangers, clamps, bolts, conduit, cable duct, and/or cable tray, etc., required to accomplish a neat and secure installation. All wires shall terminate in a spade lug and barrier strip, wire wrap terminal or punch block. Unfinished or unlabeled wire connections shall not be allowed. Turn over to the RE all unused and partially opened installation kit boxes, coaxial, fiberoptic, and twisted pair cable reels, conduit, cable tray, and/or cable duct bundles, wire rolls, physical installation hardware. The following are the minimum required installation sub-kits:

System Grounding:

The grounding kit shall include all cable and installation hardware required. All radio equipment shall be connected to earth ground via internal building wiring, according to the NEC.

This includes, but is not limited to:

Fiberoptic Optic Cable Armor/External Braid
Coaxial Cable Shields.

Control Cable Shields.

Data Cable Shields.

Equipment Racks.

Equipment Cabinets.

Conduits.

Cable Duct.

Cable Trays.

Interduct

Power Panels.

Connector Panels.

15) Grounding Blocks.

Fiberoptic Cable: The fiberoptic cable kit shall include all fiberoptic connectors, cable tying straps, interduct, heat shrink tubing, hangers, clamps, etc. required to accomplish a neat and secure installation.

Coaxial Cable: The coaxial cable kit shall include all coaxial connectors, cable tying straps, heat shrink tubing, hangers, clamps, etc., required to accomplish a neat and secure installation.

Wire and Cable: The wire and cable kit shall include all connectors and terminals, audio spade lugs, barrier straps, punch blocks, wire wrap strips, heat shrink tubing, tie wraps, solder, hangers, clamps, labels etc., required to accomplish a neat and orderly installation.

Conduit, Cable Duct, and Cable Tray: The kit shall include all conduit, duct, trays, junction boxes, back boxes, cover plates, feed through nipples, hangers, clamps, other hardware required to accomplish a neat and secure conduit, cable duct, and/or cable tray installation in accordance with the NEC and this document.

Equipment Interface: The equipment kit shall include any item or quantity of equipment, cable, mounting hardware and materials needed to interface the systems with the identified sub-system(s) according to the OEM requirements and this document.

Labels: The labeling kit shall include any item or quantity of labels, tools, stencils, and materials needed to completely and correctly label each subsystem according to the OEM requirements, as-installed drawings, and this document.

Documentation: The documentation kit shall include any item or quantity of items, computer discs, as installed drawings, equipment, maintenance, and operation manuals, and OEM materials needed to

completely and correctly provide the system documentation as required by this document and explained herein.

PART 3 - EXECUTION

3.1 PROJECT MANAGEMENT

Assign a single project manager to this project who will serve as the point of contact for the Owner, the General Contractor, and the Engineer.

The Contractor shall be proactive in scheduling work at the hospital, specifically the Contractor will initiate and maintain discussion with the general contractor regarding the schedule for ceiling cover up and install cables to meet that schedule.

Contact the Office of Telecommunications, Special Communications Team (0050P2B) at (301) 734-0350 to have a VA Certified Telecommunications COTR assigned to the project for telecommunications review, equipment and system approval and co-ordination with VA's Spectrum Management and OCIS Teams.

3.2 COORDINATION WITH OTHER TRADES

- A. Coordinate with the cabling contractor the location of the TV faceplate and the faceplate opening for the nurse call TV control jack.
- B. Coordinate with the cabling contractor the location of TIP equipment in the TER, TCR, PCR, SCC, ECR, STRS, NSS, and TCOs in order to connect to the TIP cable network that was installed as a part of Section Specification 27 11 00. Contact the RE immediately, in writing, if additional location(s) are discovered to be activated that was not previously provided.
- C. Before beginning work, verify the location, quantity, size and access for the following:
 - Isolated ground AC power circuits provided for systems.
 - Primary, emergency and extra auxiliary AC power generator requirements.
 - Junction boxes, wall boxes, wire troughs, conduit stubs and other related infrastructure for the systems.
 - System components installed by others.
 - Overhead supports and rigging hardware installed by others.
- D. Immediately notify the Owner, GC and Consultant(s) in writing of any discrepancies.

3.3 NEEDS ASSESSMENT

Provide a one-on-one meeting with the particular nursing manager of each unit affected by the installation of the new nurse call/code blue system. Review the floor plan drawing, educate the nursing manager with the functions of the equipment that is being provided and gather details specific to the individual units; coverage and priorities of calls; staffing patterns; and other pertinent details that will affect system programming and training.

3.4 INSTALLATION

A. General:

1. Execute work in accordance with National, State and local codes, regulations and ordinances.
2. Install work neatly, plumb and square and in a manner consistent with standard industry practice. Carefully protect work from dust, paint and moisture as dictated by site conditions. The Contractor will be fully responsible for protection of his work during the construction phase up until final acceptance by the Owner.
3. Install equipment according to OEM's recommendations. Provide any hardware, adaptors, brackets, rack mount kits or other accessories recommended by OEM for correct assembly and installation.
4. Secure equipment firmly in place, including receptacles, speakers, equipment racks, system cables, etc.

All supports, mounts, fasteners, attachments and attachment points shall support their loads with a safety factor of at least 5:1.

Do not impose the weight of equipment or fixtures on supports provided for other trades or systems.

Any suspended equipment or associated hardware must be certified by the OEM for overhead suspension.

The Contractor is responsible for means and methods in the design, fabrication, installation and certification of any supports, mounts, fasteners and attachments.

5. Finishes for any exposed work such as plates, racks, panels, speakers, etc. shall be approved by the Architect, Owner and TVE 0050P3B.
6. Coordinate cover plates with field conditions. Size and install cover plates as necessary to hide joints between back boxes and surrounding wall. Where cover plates are not fitted with

connectors, provide grommets holes in size and quantity required. Do not allow cable to leave or enter boxes without cover plates installed.

7. Active electronic component equipment shall consist of solid state components, be rated for continuous duty service, comply with the requirements of FCC standards for telephone and data equipment, systems, and service.
8. Color code all distribution wiring to conform to the Nurse Call Industry Standard, EIA/TIA, and this document, whichever is the more stringent. At a minimum, all equipment, cable duct and/or conduit, enclosures, wiring, terminals, and cables shall be clearly and permanently labeled according to and using the provided record drawings, to facilitate installation and maintenance.
9. Connect the System's primary input AC power to the Facility' Critical Branch of the Emergency AC power distribution system as shown on the plans or if not shown on the plans consult with RE regarding a suitable circuit location prior to bidding.

10. Product Delivery, Storage and Handling:

Delivery: Deliver materials to the job site in OEM's original unopened containers, clearly labeled with the OEM's name and equipment catalog numbers, model and serial identification numbers. The RE may inventory the cable, patch panels, and related equipment.

Storage and Handling: Store and protect equipment in a manner, which will preclude damage as directed by the RE.

11. Where TCOs are installed adjacent to each other, install one outlet for each instrument.
12. Equipment installed outdoors shall be weatherproof or installed in weatherproof enclosures with hinged doors and locks with two keys.

B. Equipment Racks/Cabinets:

Fill unused equipment mounting spaces with blank panels or vent panels. Match color to equipment racks/cabinets.

Provide security covers for all devices not requiring routine operator control.

Provide vent panels and cooling fans as required for the operation of equipment within the OEM' specified temperature limits. Provide adequate ventilation space between equipment for cooling. Follow

manufacturer's recommendations regarding ventilation space between amplifiers.

Provide insulated connections of the electrical raceway to equipment racks.

Provide continuous raceway/conduit with no more than 40% fill between wire troughs and equipment racks/cabinets for all non-plenum-rated cable. Ensure each system is mechanically separated from each other in the wireway.

Ensure a minimum of 36 inches around each cabinet and/or rack to comply with OSHA Safety Standards. Cabinets and/or Racks installed side by side - the 36" rule applies to around the entire assembly

C. Distribution Frames.

A new stand-alone (i.e., self supporting, free standing) PA rack/frame may be provided in each TR to interconnect the TCR, PCR, SCC, NS, STRs & ECRs. Rack/frames shall be wired in accordance with industry standards and shall employ "latest state-of-the-art" modular cross-connect devices. The PA riser cable shall be sized to satisfy all voice/digital requirements plus not less than 50% spare (growth) capacity in each TR which includes a fiber optic backbone. The frames/racks shall be connected to the TER/MCR system ground.

D. Wiring Practice - in addition to the MANDATORY infrastructure requirements outlined in VA Construction Specifications 27 10 00 - TIP Structured Communications Cabling, 27 11 00 - TIP Communications Rooms Fittings and 27 15 00 - TIP Horizontal and Vertical Communicators Cabling, the following additional practices shall be adhered too:

1. Comply with requirements for raceways and boxes specified in Division 26 Section "Raceway and Boxes for Electrical Systems."
2. Execute all wiring in strict adherence to the National Electrical Code, applicable local building codes and standard industry practices.
3. Wiring shall be classified according to the following low voltage signal types:
 - Balanced microphone level audio (below -20dBm) or Balanced line level audio (-20dBm to +30dBm)
 - 70V audio speaker level audio.
 - Low voltage DC control or power (less than 48VDC)
4. Where raceway is to be EMT (conduit), wiring of differing classifications shall be run in separate conduit. Where raceway is

to be an enclosure (rack, tray, wire trough, utility box) wiring of differing classifications which share the same enclosure shall be mechanically partitioned and separated by at least four (4) inches. Where Wiring of differing classifications must cross, they shall cross perpendicular to one another.

5. Do not splice wiring anywhere along the entire length of the run. Make sure cables are fully insulated and shielded from each other and from the raceway for the entire length of the run.
6. Do not pull wire through any enclosure where a change of raceway alignment or direction occurs. Do not bend wires to less than radius recommended by manufacturer.
7. Replace the entire length of the run of any wire or cable that is damaged or abraided during installation. There are no acceptable methods of repairing damaged or abraided wiring.
8. Use wire pulling lubricants and pulling tensions as recommended by the OEM.
9. Use grommets around cut-outs and knock-outs where conduit or chase nipples are not installed.
10. Do not use tape-based or glue-based cable anchors.
11. Ground shields and drain wires to the Facility's signal ground system as indicated by the drawings.
12. Field wiring entering equipment racks shall be terminated as follows:

Provide OEM directed service loops at harness break-outs and at plates, panels and equipment. Loops should be sufficient to allow plates, panels and equipment to be removed for service and inspection.

Line level and speaker level wiring may be terminated inside the equipment rack using specified terminal blocks (see "Products.")

Provide 15% spare terminals inside each rack. Microphone level wiring may only be terminated at the equipment served.

If specified terminal blocks are not designed for rack mounting, utilize 3/4" plywood or 1/8" thick aluminum plates/blank panels as a mounting surface. Do not mount on the bottom of the rack.

Employ permanent strain relief for any cable with an outside diameter of 1" or greater.
13. Use only balanced audio circuits unless noted otherwise directed and indicated on the drawings.

14. Make all connections as follows:

Make all connections using rosin-core solder or mechanical connectors appropriate to the application.

For crimp-type connections, use only tools that are specified by the manufacturer for the application.

Use only insulated spade lugs on screw terminals. Spade lugs shall be sized to fit the wire gauge. Do not exceed two lugs per terminal.

Wire nuts, electrical tape or "Scotch Lock" connections are not acceptable for any application.

15. Noise filters and surge protectors shall be provided for each equipment interface cabinet, switch equipment cabinet, control console, local, and remote active equipment locations to ensure protection from input primary AC power surges and noise glitches are not induced into low Voltage data circuits.

16. Wires or cables **previously approved** to be installed outside of conduit, cable trays, wireways, cable duct, etc:

a Only when specifically authorized as described herein, will wires or cables be identified and approved to be installed outside of conduit. The wire or cable runs shall be UL rated plenum and OEM certified for use in air plenums.

b Wires and cables shall be hidden, protected, fastened and tied at 600 mm (24 in.) intervals, maximum, as described herein to building structure.

c Closer wire or cable fastening intervals may be required to prevents sagging, maintain clearance above suspended ceilings, remove unsightly wiring and cabling from view and discourage tampering and vandalism. Wire or cable runs, not provided in conduit, that penetrate outside building walls, supporting walls, and two hour fire barriers shall be sleeved and sealed with an approved fire retardant sealant.

d Wire or cable runs to system components installed in walls (i.e.: volume attenuators, circuit controllers, signal, or data outlets, etc.) may, when specifically authorized by the RE, be fished through hollow spaces in walls and shall be certified for use in air plenum areas.

e Completely test all of the cables after installation and replace any defective cables.

f Wires or cables that are installed outside of buildings shall be in conduit, secured to solid building structures. If specifically approved, on a case by case basis, to be run outside of conduit, the wires or cables shall be installed, as described herein. The bundled wires or cables must: Be tied at not less than 460 mm (18 in.) intervals to a solid building structure; have ultra violet protection and be totally waterproof (including all connections). The laying of wires or cables directly on roof tops, ladders, drooping down walls, walkways, floors, etc. is not allowed and will not be approved.

- E. Cable Installation - Cable Installation - In addition to the **MANDATORY** infrastructure requirements outlined in VA Construction Specifications 27 10 00 - Structured TIP Communications Cabling, 27 11 00 - TIP Communications Rooms and Fittings and 27 15 00 - TIP Communications Horizontal and Vertical Cabling and the following additional practices shall be adhered to:

Support cable on maximum 2'-0" centers. Acceptable means of cable support are cable tray, j-hooks, and bridal rings. Velcro wrap cable bundles loosely to the means of support with plenum rated Velcro straps. Plastic tie wraps are not acceptable as a means to bundle cables.

Run cables parallel to walls.

Install maximum of 10 cables in a single row of J-hooks. Provide necessary rows of J-hooks as required by the number of cables.

Do not lay cables on top of light fixtures, ceiling tiles, mechanical equipment, or ductwork. Maintain at least 2'-0" clearance from all shielded electrical apparatus.

All cables shall be tested after the total installation is fully complete. All test results are to be documented. All cables shall pass acceptable test requirements and levels. Contractor shall remedy any cabling problems or defects in order to pass or comply with testing. This includes the re-pull of new cable as required at no additional cost to the Owner.

Ends of cables shall be properly terminated on both ends per industry and OEM's recommendations.

Provide proper temporary protection of cable after pulling is complete before final dressing and terminations are complete. Do not

leave cable lying on floor. Bundle and tie wrap up off of the floor until you are ready to terminate.

Terminate all conductors; no cable shall contain unterminated elements. Make terminations only at outlets and terminals.

Splices, Taps, and Terminations: Arrange on numbered terminal strips in junction, pull, and outlet boxes; terminal cabinets; and equipment enclosures. Cables may not be spliced.

Bundle, lace, and train conductors to terminal points without exceeding OEM's limitations on bending radii. Install lacing bars and distribution spools.

Cold-Weather Installation: Bring cable to room temperature before dereeling. Heat lamps shall not be used.

Cable shall not be run through structural members or be in contact with pipes, ducts, or other potentially damaging items.

Separation of Wires: (REFER TO RACEWAY INSTALLATION) Separate speaker-microphone, line-level, speaker-level, and power wiring runs. Install in separate raceways or, where exposed or in same enclosure, separate conductors at least 12 inches apart for speaker microphones and adjacent parallel power and telephone wiring. Separate other intercommunication equipment conductors as recommended by equipment manufacturer.

Serve all cables as follows:

Cover the end of the overall jacket with a 1" (minimum) length of transparent heat-shrink tubing. Cut unused insulated conductors 2" (minimum) past the heat-shrink, fold back over jacket and secure with cable-tie. Cut unused shield/drain wires 2" (minimum) past the Heatshrink and serve as indicated below.

Cover shield/drain wires with heat-shrink tubing extending back to the overall jacket. Extend tubing 1/4" past the end of unused wires, fold back over jacket and secure with cable tie.

For each solder-type connection, cover the bare wire and solder connection with heat-shrink tubing.

F. Labeling: Provide labeling in accordance with ANSI/EIA/TIA-606-A. All lettering for Nurse Call and/or Code Blue circuits shall be stenciled using **laser printers**.

1. Cable and Wires (Hereinafter referred to as "Cable"): Cables shall be labeled at both ends in accordance with ANSI/EIA/TIA-606-A.

Labels shall be permanent in contrasting colors. Cables shall be identified according to the System "Record Wiring Diagrams."

2. Equipment: System equipment shall be permanently labeled with contrasting plastic laminate or Bakelite material. System equipment shall be labeled on the face of the unit corresponding to its source.

Clearly, consistently, logically and permanently mark switches, connectors, jacks, relays, receptacles and electronic and other equipment.

Engrave and paint fill all receptacle panels using 1/8" (minimum) high lettering and contrasting paint.

For rack-mounted equipment, use engraved Lamacoid labels with white 1/8" (minimum) high lettering on black background.

Label the front and back of all rack-mounted equipment.

3. Conduit, Cable Duct, and/or Cable Tray: The Contractor shall label all conduit, duct and tray, including utilized GFE, with permanent marking devices or spray painted stenciling a minimum of 3 meters (10 ft.) identifying it as the System. In addition, each enclosure shall be labeled according to this standard.
4. Termination Hardware: The Contractor shall label TCOs and patch panel connections using color coded labels with identifiers in accordance with ANSI/EIA/TIA-606-A and the "Record Wiring Diagrams."
5. Where multiple pieces of equipment reside in the same rack group, clearly and logically label each indicating to which room, channel, receptacle location, etc. they correspond.
6. Permanently label cables at each end, including intra-rack connections. Labels shall be covered by the same, transparent heat-shrink tubing covering the end of the overall jacket. Alternatively, computer generated labels of the type which include a clear protective wrap may be used.
7. Contractor's name shall appear no more than once on each continuous set of racks. The Contractor's name shall not appear on wall plates or portable equipment.
8. Ensure each OEM supplied item of equipment has appropriate UL Labels / Marks for the service the equipment is performed permanently attached / marked to a non-removal board in the unit. **EQUIPMENT INSTALLED NOT BEARING THESE UL MARKS WILL NOT BE ALLOWED TO BE A**

PART OF THE SYSTEM. THE CONTRACTOR SHALL BEAR ALL COSTS REQUIRED TO PROVIDE REPLACEMENT EQUIPMENT WITH APPROVED UL MARKS.

G. Conduit and Signal Ducts: When the Contractor and/or OEM determines additional system conduits and/or signal ducts are required in order to meet the system minimum performance standards outlined herein, the contractor shall provide these items as follows:

1. Conduit:

The Contractor shall employ the latest installation practices and materials. The Contractor shall provide conduit, junction boxes, connectors, sleeves, weather heads, pitch pockets, and associated sealing materials not specifically identified in this document as GFE. Conduit penetrations of walls, ceilings, floors, interstitial space, fire barriers, etc., shall be sleeved and sealed.

All cables shall be installed in separate conduit and/or signal ducts (exception from the separate conduit requirement to allow Nurse Call and/or Code Blue cables to be installed in partitioned cable tray with voice cables may be granted in writing by the RE if requested). Conduits shall be provided in accordance with Section 27 05 33, RACEWAYS AND BOXES FOR COMMUNICATIONS SYSTEMS, and NEC Articles 517 for Critical Care and 800 for Communications systems, at a minimum.

When metal, plastic covered, etc., flexible cable protective armor or systems are specifically authorized to be provided for use in the System, their installation guidelines and standards shall be as specified herein, Section 27 05 33, RACEWAYS AND BOXES FOR COMMUNICATIONS SYSTEMS, and the NEC.

When "interduct" flexible cable protective systems is specifically authorized to be provided for use in the System, it's installation guidelines and standards shall be as the specified herein, Section 27 05 33, RACEWAYS AND BOXES FOR COMMUNICATIONS SYSTEMS, and the NEC.

Conduit fill (including GFE approved to be used in the system) shall not exceed 40%. Each conduit end shall be equipped with a protective insulator or sleeve to cover the conduit end, connection nut or clamp, to protect the wire or cable during installation and remaining in the conduit. Electrical power

conduit shall be installed in accordance with the NEC. AC power conduit shall be run separate from signal conduit.

- f. Ensure that Critical Care Nurse Call and/or Code Blue Systems (as identified by NEC Section 517) are completely separated and protected from all other systems.

2. Signal Duct, Cable Duct, or Cable Tray:

The Contractor shall use GFE signal duct, cable duct, and/or cable tray, when identified and approved by the RE.

Approved signal and/or cable duct shall be a minimum size of 100 mm x 100 mm (4 in. X 4 in.) inside diameter with removable tops or sides, as appropriate. Protective sleeves, guides or barriers are required on all sharp corners, openings, anchors, bolts or screw ends, junction, interface and connection points.

Approved cable tray shall be fully covered, mechanically and physically partitioned for multiple electronic circuit use, and be UL certified and labeled for use with telecommunication circuits and/or systems. The RE shall approve width and height dimensions.

All cable junctions and taps shall be accessible. Provide an 8" X 8" X 4" (minimum) junction box attached to the cable duct or raceway for installation of distribution system passive equipment. Ensure all equipment and tap junctions are accessible

3.5 PROTECTION OF NETWORK DEVICES

- A. Contractor shall protect network devices during unpacking and installation by wearing manufacturer approved electrostatic discharge (ESD) wrist straps tied to chassis ground. The wrist strap shall meet OSHA requirements for prevention of electrical shock, should technician come in contact with high voltage.

3.6 CUTTING, CLEANING AND PATCHING

It shall be the responsibility of the contractor to keep their work area clear of debris and clean area daily at completion of work.

It shall be the responsibility of the contractor to patch and paint any wall or surface that has been disturbed by the execution of this work.

The Contractor shall be responsible for providing any additional cutting, drilling, fitting or patching required that is not indicated as provided by others to complete the Work or to make its parts fit together properly.

The Contractor shall not damage or endanger a portion of the Work or fully or partially completed construction of the Owner or separate contractors by cutting, patching or otherwise altering such construction, or by excavation. The Contractor shall not cut or otherwise alter such construction by the Owner or a separate contractor except with written consent of the Owner and of such separate contractor; such consent shall not be unreasonably withheld. The Contractor shall not unreasonably withhold from the Owner or a separate Contractor the Contractor's consent to cutting or otherwise altering the Work.

Where coring of existing (previously installed) concrete is specified or required, including coring indicated under unit prices, the location of such coring shall be clearly identified in the field and the location shall be approved by the Project Manager prior to commencement of coring work.

3.7 FIREPROOFING

Where Nurse Call and/or Code Blue wires, cables and conduit penetrate fire rated walls, floors and ceilings, fireproof the opening.

Provide conduit sleeves (if not already provided by electrical contractor) for cables that penetrate fire rated walls and Telecommunications Rooms floors and ceilings. After the cabling installation is complete, install fire proofing material in and around all conduit sleeves and openings. Install fire proofing material thoroughly and neatly. Seal all floor and ceiling penetrations.

Use only materials and methods that preserve the integrity of the fire stopping system and its rating.

Install fireproofing where low voltage cables are installed in the same manholes with high voltage cables; also cover the low voltage cables with arc proof and fireproof tape.

Use approved fireproofing tape of the same type as used for the high voltage cables, and apply the tape in a single layer, one-half lapped or as recommended by the manufacturer. Install the tape with the coated side towards the cable and extend it not less than 25 mm (one inch) into each duct.

Secure the tape in place by a random wrap of glass cloth tape.

3.8 GROUNDING

A. Ground Nurse Call and/or Code Blue cable shields and equipment to eliminate shock hazard and to minimize ground loops, commonmode

returns, noise pickup, cross talk, and other impairments as specified in CFM Division 27, Section 27 05 26 - Grounding and Bonding for Communications Systems.

Facility Signal Ground Terminal: Locate at main room or area signal ground within the room (i.e. head end and telecommunications rooms) or area(s) and indicate each signal ground location on the drawings. Extend the signal ground to inside each equipment cabinet and/or rack. Ensure each cabinet and/or rack installed item of equipment is connected to the extended signal ground. Isolate the signal ground from power and major equipment grounding systems.

When required, install grounding electrodes as specified in CFM Division 26, Section 26 05 26 -Grounding and Bonding for Electrical Systems.

Do not use "3rd or 4th" wire internal electrical system conductors for communications signal ground.

Do not connect the signal ground to the building's external lightning protection system.

Do Not "mix grounds" of different systems.

Insure grounds of different systems are installed as to not violate OSHA Safety and NEC installation requirements for protection of personnel.

PART 4 - TESTING / GUARANTY / TRAINING

4.0 SYSTEM LISTING

The Nurses Call System is NFPA listed as an "Emergency" Communication system. Where Code Blue signals are transmitted, that listing is elevated to "Life Support/Safety." Therefore, the following testing and guaranty provisions are the minimum to be performed and provided by the contractor and Warranted by the OEM.

4.1 PROOF OF PERFORMANCE TESTING

A. Intermediate Testing:

1. After completion of 30 - 40% of the installation of a head end cabinet(s) **and interconnection to the corresponding System Patient Head wall Units** and equipment, one master stations, local and remote stations, treatment rooms, and prior to any further work, this portion of the system must be pretested, inspected, and lcertified. Each item of installed equipment shall be checked to ensure appropriate UL Listing and Certification Labels are affixed as required by NFPA -Life Safety Code 101-3.2 (a) & (b), UL Nurse Call Standard 1069 and JCHCO evaluation guidelines, and proper

installation practices are followed. The intermediate test shall include a full operational test.

2. All inspections and tests shall be conducted by an OEM-certified contractor representative and witnessed by TVE-0050P3B if there is no local Government Representative that processes OEM and VA approved Credentials to inspect and certify the system. The results of the inspection will be officially recorded by the Government Representative and maintained on file by the RE, until completion of the entire project. The results will be compared to the Acceptance Test results. An identical inspection may be conducted between the 65 - 75% of the system construction phase, at the direction of the RE.

B. Pretesting:

Upon completing installation of the Nurse Call and/or Code Blue System, the Contractor shall align, balance, and completely pretest the entire system under full operating conditions.

Pretesting Procedure:

During the System Pretest the Contractor shall verify (utilizing approved test equipment) that the System is fully operational and meets all the System performance requirements of this standard.

The Contractor shall pretest and verify that all PSM System functions and specification requirements are met and operational, no unwanted aural effects, such as signal distortion, noise pulses, glitches, audio hum, poling noise, etc. are present. At a minimum, each of the following locations shall be fully pretested:

- 1) Central Control Cabinets.
- 2) Nurse Control Stations.
 - Master Stations
 - Patient Stations
 - Staff Stations
 - Emergency Stations
 - Code Blue Stations
- 3) Dome Lights.
 - Patient Rooms
 - Corridors
 - Intersectional
- 4) STRs

Local and Remote Enunciation Panels (code blue).
 Electrical Supervision Panels/Functions/locations.
 All Networked locations.
 System interface locations (i.e. wireless, PA, telephone,
 etc.).
 System trouble reporting.
 System electrical supervision.
 UPS operation.
 Primary / Emergency AC Power Requirements
 Extra Auxiliary Generator Requirements.
 NSs.

The Contractor shall provide four (4) copies of the recorded system pretest measurements and the written certification that the System is ready for the formal acceptance test shall be submitted to the RE.

C. Acceptance Test:

After the Nurse Call and/or Code Blue System has been pretested and the Contractor has submitted the pretest results and certification to the RE, then the Contractor shall schedule an acceptance test date and give the RE 15 working days written notice prior to the date the acceptance test is expected to begin. The System shall be tested in the presence of a TVE 0050P3B and OEM certified representatives. The System shall be tested utilizing the approved test equipment to certify proof of performance and Life Safety / Critical Service compliance. The tests shall verify that the total System meets all the requirements of this specification. The notification of the acceptance test shall include the expected length (in time) of the test.

The acceptance test shall be performed on a "go-no-go" basis. Only those operator adjustments required to show proof of performance shall be allowed. The test shall demonstrate and verify that the installed System does comply with all requirements of this specification under operating conditions. The System shall be rated as either acceptable or unacceptable at the conclusion of the test. Failure of any part of the System that precludes completion of system testing, and which cannot be repaired in four (4) hours, shall be cause for terminating the acceptance test of the System. Repeated failures that result in a cumulative time of eight (8)

hours to affect repairs shall cause the entire System to be declared unacceptable.

3. Retesting of the entire System shall be rescheduled at the convenience of the Government and costs borne by the Contractor at the direction of the SRE.

D. Acceptance Test Procedure:

1. Physical and Mechanical Inspection:

The TVE 0050P3B Representative will tour all major areas where the Nurse Call and/or Code Blue System and all sub-systems are completely and properly installed to insure they are operationally ready for proof of performance testing. A system inventory including available spare parts will be taken at this time. Each item of installed equipment shall be checked to ensure appropriate UL certification labels are affixed.

The System diagrams, record drawings, equipment manuals, TIP Auto CAD Disks, intermediate, and pretest results shall be formally inventoried and reviewed.

Failure of the System to meet the installation requirements of this specification shall be grounds for terminating all testing.

2. Operational Test:

After the Physical and Mechanical Inspection, the central terminating and nurse call master control equipment shall be checked to verify that it meets all performance requirements outlined herein. A spectrum analyzer and sound level meter may be utilized to accomplish this requirement.

Following the central equipment test, a pillow speaker (or on board speaker) shall be connected to the central terminating and nurse call master control equipment's output tap to ensure there are no signal distortions such as intermodulation, data noise, popping sounds, erratic system functions, on any function.

The distribution system shall be checked at each interface, junction, and distribution point, first, middle, and last intersectional, room, and bed dome light in each leg to verify that the nurse call distribution system meets all system performance standards.

Each MATV outlet that is controlled by a nurse call pillow speaker shall be functionally tested at the same time utilizing

the Contractor's approved hospital grade HDTV receiver and TV remote control cable.

The RED system and volume stepper switches shall be checked to insure proper operation of the pillow speaker, the volume stepper and the RED system (if installed).

Additionally, each installed emergency, patient, staff, duty, panic station, intersectional, room, and bed dome light, power supply, code one, and remote annunciator panels shall be checked insuring they meet the requirements of this specification.

Once these tests have been completed, each installed sub-system function shall be tested as a unified, functioning and fully operating system. The typical functions are: nurse follower, three levels of emergency signaling (i.e. flashing red emergency, flashing white patient emergency, flashing white or combination lights for staff emergency, separate flashing code blue), minimum of 10 minutes of UPS operation, memory saving, minimum of ten station audio paging, canceling emergency calls at each originating station only, and storage and prioritizing of calls.

Individual Item Test: The TVE 0050P3B Representative will select individual items of equipment for detailed proof of performance testing until 100% of the System has been tested and found to meet the contents of this specification. Each item shall meet or exceed the minimum requirements of this document.

3. Test Conclusion:

At the conclusion of the Acceptance Test, using the generated punch list (or discrepancy list) the VA and the Contractor shall jointly agree to the results of the test, and reschedule testing on deficiencies and shortages with the RE. Any retesting to comply with these specifications will be done at the Contractor's expense.

If the System is declared unacceptable without conditions, all rescheduled testing expenses will be borne by the Contractor.

E. Acceptable Test Equipment: The test equipment shall furnished by the Contractor shall have a calibration tag of an acceptable calibration service dated not more than 12 months prior to the test. As part of the submittal, a test equipment list shall be furnished that includes the make and model number of the following type of equipment as a minimum: 1. Spectrum Analyzer.

Signal Level Meter.

Volt-Ohm Meter.

Sound Pressure Level (SPL) Meter.

Oscilloscope.

Pillow Speaker Test Set (Pillow Speaker with appropriate load and cross connections in lieu of the set is acceptable).

Patient Push Button Cord Test Set.

Patient Bed with connecting multiple conductor cord.

4.2 SYSTEM GUARANTEE PERIOD OF SERVICE

A. Contractor's Responsibility:

The Contractor shall guarantee that all provided material and equipment will be free from defects, workmanship and will remain so for a period of one year from date of final acceptance of the System by the VA. The Contractor shall provide OEM's equipment warranty documents, to the RE (or Facility Contracting Officer if the Facility has taken possession of the building), that certifies each item of equipment installed conforms to OEM published specifications.

The Contractor's maintenance personnel shall have the ability to contact the Contractor and OEM for emergency maintenance and logistic assistance, remote diagnostic testing, and assistance in resolving technical problems at any time. This contact capability shall be provided by the Contractor and OEM at no additional cost to the VA.

All Contractor maintenance and supervisor personnel shall be fully qualified by the OEM and must provide two (2) copies of current and qualified OEM training certificates and OEM certification upon request.

Additionally, the Contractor shall accomplish the following minimum requirements during the two year guaranty period: a. Response Time during the Two Year Guaranty Period:

The RE (or Facility Contracting Officer if the system has been turned over to the Facility) is the Contractor's ONLY OFFICIAL reporting and contact official for nurse call system trouble calls, during the guaranty period.

A standard work week is considered 8:00 A.M. to 5:00 P.M. or as designated by the RE (or Facility Contracting Officer), Monday through Friday exclusive of Federal Holidays.

- 3) The Contractor shall respond and correct on-site trouble calls, during the standard work week to:

A routine trouble call within one (1) working day of its report. A routine trouble is considered a trouble which causes a pillow speaker or cordset, one (1) master nurse control station, patient station, emergency station, or dome light to be inoperable.

Routine trouble calls in critical emergency health care facilities (i.e., cardiac arrest, intensive care units, etc.) shall also be deemed as an emergency trouble call. The RE (or Facility Contracting Officer) shall notify the Contractor of this type of trouble call.

An emergency trouble call within four hours of its report. An emergency trouble is considered a trouble which causes a sub-system (ward), distribution point, terminal cabinet, or code one system to be inoperable at anytime.

- 4) If a Nurse Call and/or Code Blue/ component failure cannot be corrected within four (4) hours (exclusive of the standard work time limits), the Contractor shall be responsible for providing alternate nurse call equipment. The alternate equipment/system shall be operational within a maximum of 20 hours after the four (4) hour trouble shooting time and restore the effected location operation to meet the System performance standards. If any sub-system or major system trouble cannot be corrected within one working day, the Contractor shall furnish and install compatible substitute equipment returning the System or sub-system to full operational capability, as described herein, until repairs are complete.

b. Required On-Site Visits during the **Two Year** Guaranty Period

- 1) The Contractor shall visit, on-site, for a minimum of eight (8) hours, once every 12 weeks, during the guaranty period, to perform system preventive maintenance, equipment cleaning, and operational adjustments to maintain the System according the descriptions identified in this document.
- 2) The Contractor shall arrange all Facility visits with the COTR prior to performing the required maintenance visits.

- 3) Preventive maintenance shall be performed by the Contractor in accordance with the OEM's recommended practice and service intervals during non-busy time agreed to by the RE (or Facility Contracting Officer) and Contractor.
- 4) The preventive maintenance schedule, functions and reports shall be provided to and approved by the COTR.
- 5) The Contractor shall provide the COTR a type written report itemizing each deficiency found and the corrective action performed during each required visit or official reported trouble call. The Contractor shall provide the COTR with sample copies of these reports for review and approval at the beginning of the Acceptance Test. The following reports are the minimum required:

The Contractor shall provide a monthly summary all equipment and sub-systems serviced during this guarantee period to COTR the fifth (5th) working day after the end of each month. The report shall clearly and concisely describe the services rendered, parts replaced and repairs performed. The report shall prescribe anticipated future needs of the equipment and systems for preventive and predictive maintenance.

The Contractor shall maintain a separate log entry for each item of equipment and each sub-system of the System. The log shall list dates and times of all scheduled, routine, and emergency calls. Each emergency call shall be described with details of the nature and causes of emergency steps taken to rectify the situation and specific recommendations to avoid such conditions in the future.

- 6) The COTR shall convey two (2) copies of actual reports for evaluation.

The COTR shall ensure a copy of these reports is entered into the System's official acquisition documents.

The COTR shall ensure a copy of these reports is entered into the System's official technical record documents. B. Work Not Included: Maintenance and repair service shall not include the performance of any work due to improper use; accidents; other vendor, contractor, or owner tampering or negligence, for which the Contractor is not directly responsible and does not control. The Contractor shall

immediately notify the COTR in writing upon the discovery of these incidents. The COTR will investigate all reported incidents and render

4.3 TRAINING

Provide thorough training of all nursing staff assigned to those nursing units receiving new networked nurse/patient communications equipment. This training shall be developed and implemented to address two different types of staff. Floor nurses/staff shall receive training from their perspective, and likewise, unit secretaries (or any person whose specific responsibilities include answering patient calls and dispatching staff) shall receive operational training from their perspective. A separate training room will be set up that allows this type of individualized training utilizing in-service training unit, prior to cut over of the new system.

Provide the following minimum training times and durations:

- 48 hours prior to opening for nursing staff (in 8-hour increments) - split evenly over 3 weeks and day and night shifts. Coordinate schedule with Owner.
- 32 hours during the opening week for nursing staff - both day and night shifts.
- 24 hours for supervisors and system administrators.

5.0 ATTACHMENTS

- A. The following items are required as a part of the system:
 - 1. COTS Documents:

CHECKLIST FOR SOFTWARE LICENSING AGREEMENTS
(For use in commercial item acquisition [COTS] conforming to – FAR Part 12)

The Government may not be able to accept standard commercial licensing agreement without modification; you must negotiate terms and conditions so it is consistent with the FAR and the VAAR.		
Is the license (check all that apply):	Yes	No
Exclusive		
Non-exclusive		
Perpetual		
Limited term		
If limited term, state the period (months or years):		
If limited term, is there an automatic renewal provision?		
CPU based		
If CPU based, state number of machines and whether simultaneous use is permitted:		
Site license		
If site license, state the site/location:		
Network license		
Other basis (e.g., # of users, # of transactions, etc.) (state specifics)		
Applicable to only the current version (doesn't apply to future versions)		
Software maintenance included at no extra cost		
Allow for office relocation or transfer		
Allow copying for backup or archival purpose		
Allow no cost copy at disaster recovery site		
Restricted on Use: (see note below)		
Restricted on the processing of data by or for user's subsidiaries and affiliates		
Restricted on processing of third party data (or use in service bureau)		
Restricted on network use		
Restricted on site and equipment limitations		
Restricted on number of users (e.g., cannot exceed # of users)		
Terms and Conditions that may need to be negotiated:	Yes	No
Does the license prohibit use of the software outside of the Government? If yes, this needs to be deleted/modified if other Government contractors need access to the software (as GFP) to fulfill obligations of their own contracts.		
Does license state that the software is Year 2000 compliant or include a Year 2000 warranty? If no, must ensure it is compliant per FAR 39 or include a Y2K warranty.		
Does the license state that it provides no warranties or guarantees of any kind? If yes, need to determine whether additional warranty would be in the best interest of the Government.		
Does the license warrant that the software does not contain any code (e.g., virus) that will disable the software, and if such code exists, that Licensor agrees to indemnify the licensee (user) for all damages suffered as a result of such code? If no, need to negotiate for such warranty.		
Does the license allow access to source code? If no, negotiate for access if software will be modified or customized for the Government's needs or if the Government intends to maintain the software itself.		
Does the license require Licensor to deposit source code in escrow account? If no and source code is needed, consider negotiating for this provision, and state what "release conditions" are.		
Does the license allow the Government to hold the rights to customized code and to the data that the software manipulates? If no, negotiate for the rights if the Government (customer) requires them.		
Does the license authorize us to copy user manuals for internal purposes? If no, negotiate for authorization if multiple copies must be made for our internal use or ensure that the vendor supplies adequate number of copies. May also negotiate for updated manuals at periodic intervals, e.g., with each major update.		
Does the license state that licensee modifications to the software void all warranties? If yes, ensure that the vendor still warrants the unmodified portions.		
Does the license include clauses that prohibit needed uses of software, restrict the use of output from the software, or inappropriately burden the operation of the computer facilities? If yes, need to negotiate better terms and conditions.		
Is the dispute clause in the license consistent with FAR 52.233-1, Disputes Clause? If no, then need to modify license to be consistent with FAR.		
Does the default clause in the license allow for the Government to terminate for convenience or for cause, consistent with FAR 52.212-4(l) or FAR 52.212-4(m)? If no, then need to modify license to be consistent with FAR Part 12 (not FAR Part 49).		

b.

SOLICITATION/CONTRACT/ORDER FOR COMMERCIAL ITEMS OFFEROR TO COMPLETE BLOCKS 12, 17, 23, 24, & 30				1. REQUISITION NUMBER	PAGE 1 OF 7
2. CONTRACT NO.	3. AWARD/EFFECTIVE DATE SEE BLOCK 31C	4. ORDER NUMBER	5. SOLICITATION NO.	6. SOLICITATION ISSUE DATE	
7. FOR SOLICITATION INFORMATION	a. NAME	b. TELEPHONE NUMBER (No collect calls)	8. OFFER DUE DATE/ LOCAL TIME		
9. ISSUED BY:	CODE	10. THIS ACQUISITION IS UNRESTRICTED SETASIDE : 100 % FOR SMALL BUSINESS HUBZONE SMALL BUSINESS 8(A) NAICS: 541511 SIZE STANDARD:	11. DELIVERY FOR FOB DESTINATION UNLESS BLOCK IS MARKED SEE SCHEDUL	12. DISCOUNT TERMS	
			13a. THIS CONTRACT IS A RATED ORDER UNDER DPAS (15 CFR 700)		
			13b. RATING		
			14. METHOD OF SOLICITATION RFQ IFB RFP		
15. DELIVER TO	CODE	16. ADMINISTERED BY	CODE		
		See #9 above			
17a. CONTRACTOR/ CODE OFFEROR	FACILITY CODE	18a. PAYMENT WILL BE MADE BY	CODE		
		UNITED STATES OF AMERICA Department of Veterans Affairs FMS P.O. Box 149971 Austin, TX 78714-8971			
TELEPHONE NO:	70	17b. CHECK IF REMITTANCE IS DIFFERENT AND PUT SUCH ADDRESS IN OFFER		18b. SUBMIT INVOICES TO ADDRESS SHOWN IN BLOCK 18a. UNLESS BLOCK BELOW IS CHECKED SEE ADDENDUM	

19. ITEM NO.	20. SCHEDULE OF SUPPLIES/SERVICES	21. QUANTI TY	22. UNI T	23. UNIT PRICE	24. AMOUNT
	See page 2 Use Reverse and/or (Attach Additional Sheets as Necessary)				
25. ACCOUNTING AND APPROPRIATION DATA				26. TOTAL AWARD AMOUNT (For Govt. Use Only)	

27a. SOLICITATION INCORPORATES BY REFERENCE FAR 52.212-1, 52.212-4. ARE NOT
 FAR 52.212-3 AND 52.212-5 ARE ATTACHED. ADDENDA ARE ATTACHED.

27b. CONTRACT/PURCHASE ORDER INCORPORATES BY REFERENCE FAR 52.212-4, 52.227-14, 52.227-16, and 52.227-19. ADDENDA ARE NOT
 ATTACHED.

28. CONTRACTOR IS REQUIRED TO DOCUMENT AND RETURN 1 COPIES TO ISSUING OFFICE. AGREES TO FURNISH AND DELIVER ALL ITEMS SET FORTH OR OTHERWISE IDENTIFIED ABOVE AND ON ANY ADDITIONAL SHEETS SUBJECT TO THE TERMS CONDITIONS SPECIFIED HEREIN.	SIGN THIS CONTRACTOR AND	29. AWARD OF CONTRACT: REF. OFFER	OFFER ON CHANGES ITEMS:
		DATED . YOUR SOLICITATION (BLOCK 5), INCLUDING ANY ADDITIONS OR WHICH ARE SET FORTH HEREIN, IS ACCEPTED AS TO	
30A. SIGNATURE OF OFFEROR/CONTRACTOR		UNITED STATES OF AMERICA (SIGNATURE OF CONTRACTING OFFICER)	
30b. NAME AND TITLE OF SIGNER (Type or Print)	30c. DATE SIGNED	NAME OF CONTRACTING OFFICER (Type or Print) Contracting Officer	DATE SIGNED

AUTHORIZED FOR LOCAL REPRODUCTION
 PREVIOUS EDITION IS NOT USABLE

COMPUTER-GENERATED

STANDARD FORM 1449
 (REV. 4/2002)
 Prescribed By
 GSA - FAR (48CFR) 53.212

19. ITEM NO.	20. SCHEDULE OF SUPPLIES/SERVICES	21. QUANTI TY	22. UNI T	23. UNIT PRICE	24. AMOUNT

This Contract is Firm Fixed Price (FFP). The Contractor is required to provide the software, software license, and software maintenance services for the computer software identified below. Distribution of maintenance copies shall be accomplished by using an appropriate magnetic, electronic or printed media. Software maintenance includes periodic updates, enhancements and corrections to the software, and reasonable technical support, all of which are customarily provided by the Contractor to its customers.

The name of the
License Type: P
Software Manufa

Governing Law. Federal law and regulations, including the Federal Acquisition Regulations ("FAR"), shall govern this Contract or Order (Contract/Order). Commercial license agreements may be made a part of this Contract/Order but only if both parties expressly make them an addendum. If the commercial license agreement is not made an addendum, it shall not apply, govern, be a part of or have any effect whatsoever on this Contract/Order; this includes, but is not limited to, any agreement embedded in the computer software (clickwrap) or any agreement that is otherwise delivered with or provided to the Government with the commercial computer software or documentation (shrinkwrap), or any other license agreement otherwise referred to in any document. If a commercial license agreement is made an addendum, only those provisions addressing data rights regarding the Government's use, duplication and disclosure of data (e.g., restricted computer software) are included and made a part of this Contract/Order, and only to the extent that those provisions are not duplicative or inconsistent with Federal law, Federal regulation or the incorporated FAR clauses; those provisions in the commercial license agreement that do not address data rights regarding the Government's use, duplication and disclosure of data shall not be included or made a part of the Contract/Order. Federal law and regulation, including without limitation, the Contract Disputes Act (41 U.S.C. §601-613), the Anti-Deficiency Act (31 U.S.C. §1341 et seq.), the Competition in Contracting Act (41 U.S.C. §251, et seq), the Prompt Payment Act (31 U.S.C. §3901, et seq.) and FAR clauses 52.212-4, 52.227-14, 52.227-19 shall supersede, control and render ineffective any inconsistent, conflicting or duplicative provision in any commercial license agreement. In the event of conflict between this clause and any provision in the Contract/Order or the commercial license agreement or elsewhere, the terms of this clause shall prevail. Claims of patent or copyright infringement brought against the Government as a party shall be defended by the U.S. Department of Justice (DOJ). 28 U.S.C. § 516. At the discretion of DOJ, the Contractor may be allowed reasonable participation in the defense of the litigation. Any additional changes to the Contract/Order must be made by contract modification (Standard Form 30). Nothing

1	Microsoft Word 2008 Software License, Part No. 9891-7069. Software may be installed on four separate personal computers and be used by any VA employee or support service contractor. Licenses are perpetual.	4	EA	\$10,000.00	\$40,000.00
2	12 months of Standard Microsoft Word Software Maintenance and Technical Support Services for the software being acquired under CLIN 1; Part No. 9891-7069.	4	EA	\$2,500.00	\$10,000.00
Total					\$50,000.00

QUANTITY IN COLUMN 21 HAS BEEN RECEIVED INSPECTED ACCEPTED, AND CONFORMS TO THE CONTRACT,

SIGNATURE OF AUTHORIZED GOVT. REPRESENTATIVE	32c. DATE	32d. PRINTED NAME AND TITLE OF AUTHORIZED GOVERNMENT REPRESENTATIVE
32e. MAILING ADDRESS OF AUTHORIZED GOVERNMENT REPRESENTATIVE		TELEPHONE NO. OF AUTHORIZED GOVERNMENT REPRESENTATIVE

EXCEPT AS NOTED:

E-MAIL OF AUTHORIZED GOVERNMENT REPRESENTATIVE

33. SHIP NUMBER	34. VOUCHER NUMBER	35. AMOUNT VERIFIED CORRECT FOR	36. PAYMENT COMPLETE PARTIAL FINAL	37. CHECK NUMBER
PARTIAL FINAL				
38. S/R ACCOUNT NUMBER	39. S/R VOUCHER NUMBER	40. PAID BY		
41a. I CERTIFY THIS ACCOUNT IS CORRECT AND PROPER FOR PAYMENT		RECEIVED BY (Print)		
41b. SIGNATURE AND TITLE OF CERTIFYING OFFICER		41c. DATE		
		RECEIVED AT (Location)		
		DATE REC'D (YY/MM/DD)	TOTAL CONTAINERS	

1449 (REV. 4/2002) STANDARD FORM BACK

ADDENDUM A -ADDITIONAL TERMS AND CONDITIONS FOR CONTRACT # OR

ORDER#

A.1 Federal Acquisition Regulation (FAR) Incorporated by Reference. The Contractor agrees to comply with the following FAR clauses, which the Contracting Officer has indicated as being incorporated in this Contract/Order by reference, to implement provisions of law or executive orders applicable to acquisitions of this nature, to implement department policy or to clarify the Government's requirement. Copies of clauses in full text will be provided on request. FAR Clauses can be viewed at <http://www.arnet.gov/far/>.

FAR 52.212-4, Contract Terms and Conditions-Commercial Items (Oct 2003)
 FAR 52.227-14, Rights in Data-General (Dec 2007), Alt III
 FAR 52.227-16, Additional Data Requirements (Jun 1987)
 FAR 52.227-19, Commercial Computer Software License (Dec 2007)

A.2 Contracting Officer's Authority. The Contracting Officer is the only person authorized to make or approve any changes in any of the requirements of this Contract, and notwithstanding any provisions contained elsewhere in this Contract/Order, the said authority remains solely within the Contracting Officer. In the event the Contractor makes any changes at the direction of any person other than the Contracting Officer, the changes will be considered to have been made without authority and no adjustment will be made in the contract price to cover any increase in costs incurred as a result thereof.

A.3 VAAR 852.270-1 Representatives of Contracting Officers (APR 1984). The Contracting Officer reserves the right to designate representatives to act for him/her in furnishing technical guidance and advice or generally supervise the work to be performed under this Contract/Order. Such designation will be in writing and will define the scope and limitations of the designee's authority. A copy of the designation shall be furnished the Contractor.

A.4 VAAR 852.270-4 Commercial Advertising (NOV 1984). The Contractor will not advertise the award of this Contract/Order in his/her commercial advertising in such a manner as to state or imply that the Department of Veterans Affairs endorses a product, project or commercial line of endeavor.

A.5 VAAR 852.237-70 Contractor Responsibilities (APR 1984) The Contractor shall obtain all necessary licenses and/or permits required to perform this work. He/she shall take all reasonable precautions necessary to protect persons and property from injury or damage during the performance of the Contract/Order. He/she shall be responsible for any injury to himself/herself, his/her employees, as well as for any damage to personal or public property that occurs during the performance of the Contract/Order that is caused by his/her employees fault or negligence, and shall maintain personal liability and property damage insurance having coverage for a limit as required by the laws of the state where services are performed. Further, it is agreed that any negligence of the Government, its officers, agents, servants and employees, shall not be the responsibility of the Contractor hereunder with the regard to any claims, loss, damage, injury, and liability resulting there from.

A.6 Indemnification. The Contractor shall save and hold harmless and indemnify the Government against any and all liability claims, and cost of whatsoever kind and nature for injury to or death of any person or persons and for loss or damage to any Contractor property or property owned by a third party occurring in connection with or in any way incident to or arising out of the occupancy, use service, operation, or performance of work under the terms of the Contract/Order, resulting in whole or in part from the acts or omissions of the Contractor, any subcontractor, or any employee, agent, or representative of the Contractor or subcontractor.

A.7 Government's Liability. The Government shall not be liable for any injury to the Contractor's personnel or damage to the Contractor's property unless such injury or damage is due to negligence on the part of the

Government and is recoverable under the Federal Torts Claims Act, or pursuant to other Federal statutory authority.

A.10 Uniform Computer Information Transaction Act (UCITA). UCITA is not applicable to the Contract/Order.

A.11 Software License and Software Maintenance Subscription and Technical Support.

(1) Definitions.

Licensee. The term "licensee" shall mean the U.S. Department of Veterans Affairs ("VA") and is synonymous with "Government."

Licensor. The term "licensor" shall mean the software manufacturer of the computer software being acquired. The term "Contractor" is the company identified in Block 17a on the SF1449. If the Contractor is a reseller and not the Licensor, the Contractor remains responsible for performance under this Contract.

Software. The term "software" shall mean the licensed computer software product(s) cited in the Schedule of Supplies (Page 2).

Maintenance. The term "maintenance" is the process of enhancing and optimizing software, as well as remedying defects. It shall include all new fixes, patches, releases, updates, versions and upgrades, as further defined below.

Technical Support. The term "technical support" refers to the range of services providing assistance for the software via the telephone, email, a website or otherwise.

Release or Update. The term "release" or "update" are terms that refer to a revision of software that contains defect corrections, minor enhancements or improvements of the software's functionality. This is usually designated by a change in the number to the right of the decimal point (e.g., from Version 5.3 to 5.4). An example of an update is the addition of new hardware.

Version or Upgrade. The term "version" or "upgrade" are terms that refer to a revision of software that contains new or improved functionality. This is usually designated by a change in the number to the left of the decimal point (e.g., from Version 5.4 to 6).

(2) License. Grant of License and Term.

See also Addendum B.

Unless otherwise stated in the Schedule of Supplies/Services, the software license provided to the Government is a perpetual, nonexclusive license to use the software.

The license authorizes the Government to use the software in processing data for other federal agencies.

If the licensed software requires a password (or license key) to be operational, it shall be delivered with the software media and have no expiration date.

If the Government decides to outsource or contract its services, the Government may allow the outsourcer to use the licensed software solely to provide the services on its behalf. The outsourcer shall be bound by the provisions of this Contract relating to the use of the software.

If the software is for use in a networked environment, as may be reflected by the number of servers or users described in the Contract/Order, the license grant provided by the Contractor includes the Government's use of the software in such environment.

Any dispute regarding the license grant or usage limitations shall be resolved in accordance with the Disputes Clause incorporated in FAR 52.212-4(d).

If the Government purchases additional licenses, the terms and conditions for those additional licenses (including technical support and upgrade subscription) shall be the same as agreed to in this Contract/Order, unless negotiated otherwise by mutual agreement of the parties.

The licensed software contains critical product functionality that meets the minimum needs of the Government and is the basis for the Government's procurement of the software; consequently, the Contractor agrees that the Government has the right to successor products at no additional cost when functionality is later unbundled from the product licensed herein and bundled into a new or different product, provided the Government is current on maintenance.

If the Contractor is a reseller for the computer software being acquired under this Contract/Order, it is permissible for the actual software manufacturer (Licensor) to deliver the software directly to the Government.

All limitations of software usage are expressly stated in the SF 1449 and Addendum A and Addendum B.

(3) Software Maintenance Subscription and Technical Support.

See also Addendum B.

Software maintenance and technical support are included at the agreed upon price. However, if additional charges are assessed during the maintenance and technical support period as a result of negotiated changes in the license (e.g., CPU upgrades), the fee shall be by mutual agreement of the parties and any dispute thereof shall be resolved in accordance with the Disputes Clause incorporated herein at FAR 52.212-4(g).

If the Government desires to continue software maintenance and support beyond the period identified in this Contract/Order, the Government will issue a separate contract or order to renew annual maintenance and technical support. Conversely, if an order or contract to renew software maintenance and technical support is not received, no assumption by the Contractor shall be made that it has been renewed. It shall not be automatically renewed.

Unless otherwise agreed, for any new additional software that may be licensed, the Contractor shall provide for software maintenance and technical support for the first year of the license at no additional cost.

Unless otherwise agreed, the Contractor shall provide VA with software maintenance, which includes periodic updates, upgrades, enhancements and corrections to the software, and reasonable technical support, all of which are customarily provided by the Contractor to its customers so as to cause the software to perform according to its specifications, documentation or demonstrated claims.

Any telephone support provided by Contractor shall be at no additional cost.

All technical support services will be provided in a timely manner in accordance with the Contractor's customary practice. However, prolonged delay in resolving software problems will be noted in the Government's various past performance records on the Contractor (e.g., www.ppirs.gov).

If the Government allows the maintenance and/or technical support to lapse and subsequently wishes to reinstate maintenance and technical support, any reinstatement fee charged shall not exceed the amounts that would have been charged if the Government had not allowed it to lapse.

A.12 Disabling Software Code. The Government requires delivery of computer software that does not contain any code that will, upon the occurrence or the nonoccurrence of any event, disable the software. Such code includes but is not limited to a computer virus, restrictive key, node lock, time-out or other function, whether implemented by electronic, mechanical, or other means, which limits or hinders the use or access to any computer software based on residency on a specific hardware configuration, frequency of duration of use, or other limiting criteria. If any such code is present, the Contractor agrees to indemnify the Government for all damages suffered as a result of a disabling caused by such code, and the Contractor agrees to remove such code upon the Government's request at no extra cost to the Government. Inability of the Contractor to remove the disabling software code will be considered an inexcusable delay and a material breach of contract, and the Government may exercise its right to terminate for cause. In addition, the Government is permitted to remove the code as it deems appropriate and charge the Contractor for consideration for the time and effort in removing the code.

A.13 Disaster Recovery Clause. Government hereby certifies to Contractor that it has a bona fide disaster plan with respect to the computer software programs used in its operations. The Contract/Order authorizes the Government's operation to maintain a second copy of software on tape for use at loading at sites that are not live (e.g. subscription-based disaster recovery services) for the sole purpose of duplicating or mirroring the software environment of the "primary" licenses at the designated licensed site and as described herein. Additionally, use of the software at the contingency sites must not include general access or any processing for program development or production. Contractor shall permit operation and testing of all licensed programs at the contingency sites as designated by the Government without prior approval and at no additional cost to the Government solely for the purpose of maintaining or implementing disaster recovery readiness including continuity of business operations. CPU's, MIPS or MSU's at these contingency sites are excluded from the total CPU's, MIPS or MSU's count included elsewhere in the Contract/Order and are not separately billable. Activation of operations at a contingency site shall be at Government's discretion. Government is authorized to install all software at the contingency sites for testing, problem resolution purposes, and to ensure there will be no operational delays in association with transition of workload from the designated licensed site to the contingency sites. Use of the software at the contingency sites in the event of a disaster shall continue until such time as normal processing can be resumed at the "primary" site regardless of the duration required. Nothing in the Contract/Order diminishes the Government's rights in accordance with the data rights clause(s). Any license keys, codes, or passwords required by the Contractor

in order to use the software at the contingency sites shall be provided to the Government within 10 days of the Government's request.

A.14 NOTICE OF THE FEDERAL ACCESSIBILITY LAW AFFECTING ALL ELECTRONIC AND INFORMATION TECHNOLOGY PROCUREMENTS (SECTION 508)

On August 7, 1998, Section 508 of the Rehabilitation Act of 1973 was amended to require that when Federal departments or agencies develop, procure, maintain, or use Electronic and Information Technology, that they shall ensure it allows Federal employees with disabilities to have access to and use of information and data that is comparable to the access to and use of information and data by other Federal employees.

Section 508 required the Architectural and Transportation Barriers Compliance Board (Access Board) to publish standards setting forth a definition of electronic and information technology and the technical and functional criteria for such technology to comply with Section 508. These standards have been developed were published with an effective date of December 21, 2000. Federal departments and agencies must develop all Electronic and Information Technology requirements to comply with the standards found in 36 CFR 1194 .___*___ in performing this contract. (Fill in Section Number and Title)

ADDENDUM B - STATEMENT OF WORK FOR CONTRACT #

ORDER#

B.1 License. BROADLY DESCRIBE COMPUTING ENVIRONMENT AND HOW VA INTENDS TO USE THE SOFTWARE, HOW ITS LICENSED, WHAT THE SOFTWARE IS EXPECTED TO DO, ETC. TO GET YOU STARTED: The Department of Veterans Affairs (VA) has a need for the computer software identified on the Schedule of Supplies/Services (page 2) (software media and license) and software support services. The software will be installed onto multiple servers at the ITAC in Austin Texas for support/training/staging of the _____ Project. These are processor-based licenses that allow for unlimited users utilizing the processor(s). Contractor shall grant the Government the necessary license to accommodate this need. VA may move the software to any other location or hardware at any time.

B.2 Maintenance. The Contractor will provide software maintenance services, which includes periodic updates, enhancements and corrections to the software, and reasonable technical support, all of which are customarily provided by the Contractor to its customers so as to cause the software to perform according to its specifications, documentation or demonstrated claims. Add detailed, specific maintenance and support information here. The Contractor will distribute maintenance updates or releases by using an appropriate magnetic, electronic, or printed media to the address in Block 15 of page one, but to the attention of Joe Smith. Alternatively, the Contractor may offer access to maintenance copies through its website. All maintenance services will be provided in a timely manner in accordance with the Contractor's customary practice. However, prolonged delay in resolving software problems will be noted in the Government's various past performance records on the Contractor ([e.g., www.ppirs.gov](http://www.ppirs.gov)).

2. MOU

**Department of
Veterans Affairs**

Memorandum

Date: (Current Date)

From: Department of Veterans Affairs
Office of Telecommunications (005OP)
Spectrum Management (005OP2H3 – Room 047)
Telecommunications Voice Engineering (005OP2H2)
810 Vermont Avenue, NW
Washington, DC 20420

Subj: Memorandum of Understanding (MOU) for Non - VA Licensed Wireless Operations

To: Facility Director (00)
(Address)
(Address)

1. The following circumstances are the minimum necessary for conditional use of Wireless Equipment / System (s) in VA Owned or Leased Facilities (here-in after referred to as 'the Facility'). VA Headquarters OI&T's (005) Spectrum Management (005OP2H3), Telecommunications Voice Engineering, Special Communications (TVE - 005OP2H2) and Office of Cyber Security (OCIS – 0050P2) are the responsible entities insuring conformity of each requirement:

Each item of equipment or system whose Radio Frequency (RF) equipment is listed under Consolidated Federal Regulations (CFR), Title 47 – Federal Communications Commission (FCC), Part 15, Chapter 7, Use of Non Licensed Devices must be installed and operated in a manner consistent with Part 15's "Safety of Life" restrictions. This information is re-emphasized in CFR, Title 15 – Department of Commerce, Under the Information Technology Management Reform Act (Public Law 104-106), National Telecommunications Information Administration (NTIA) Manual of Regulations and Procedures for Federal Radio Frequency Management (aka 'The Red Book').

FCC Part 15 listed RF devices ***shall not*** be Installed or used in areas where "Safety of Life" functions / operations are accomplished or where a 'Code Blue' enunciation may occur. A list of the minimum areas affected by this statement is provided as Attachment One.

If external or internal interference is detected and cannot be corrected, ***the FCC Part 15 Listed RF Equipment affected must be turned off until corrections and/or substitutions can be made.*** Contact VA's Office of Spectrum Management (OSM – 005OP2H3), 202 461-5301 for specific conditional approval(s) concerning this issue.

3. Risk Assessment

Department of
Veterans Affairs

Memorandum

Date: (current date)

From: Director (XXXXXX)
Address
Address
Address

Subj: VA Headquarters (VACO) Memorandum of Understanding (MOU) for Federal Communications Commission (FCC) Part 15 Listed "Non-Regulated Equipment Wireless Operations"

To: Department of Veterans Affairs
Office of Telecommunications (0050P)
Spectrum Management (0050P2H3)
Telecommunications Voice Engineering (0050P2H2)
1335 East West Highway, 3rd Floor
Silver Spring, Maryland 20420

1. We have received the subject VACO MOU (signed copy attached), and are pleased to provide the following information and comments for your review that includes our risks and risk-mitigation factors that prompted our Facility's decision:

a. RISK ASSESSMENT AND MITIGATION:

(1) Background:

(a) Boise VAMC (here-in-after referred to as "the Facility") has used (OEM Mdl Nr©) for over 10 years to allow nurses in the telemetry studio to communicate with nurses at the patients' bedside. This communication medium is a vital patient safety tool that allows for rapid response to the development of a potentially fatal arrhythmia such as ventricular tachycardia. The only information the telemetry technician states on the phone is "bed 109-2 Smith has an alarm for XXXXX." Last four is never communicated. In terms of the pager we have limited the information on the pager to sector, bed number and last name. We must include the last name as occasionally the patients are moved without the knowledge of the telemetry technician, if we were to have a patient mix up the page must contain the last name for safety reasons. Facility Management Services (FMS) has restricted paging access to the telemetry system only. Because pager access is restricted, only an administrator from Technology and Information Management (TIM) or FMS can troubleshoot a pager malfunction.

VAMC (Boise), (Idaho - 83702-4598), Unregulated FCC Equipment Use, Risk Assessment and Mitigation, Page Two

Because the phones are used 24X7 and have exceeded their life expectancy, many of them have begun to fail which creates a need to purchase newer models that will continue to insure system integrity.

Our Facility has been prevented from purchasing replacement phones because VACO now has updated security and Information Technology (IT) connection controls along with continuing FCC Part 15 restrictions (described in the attached MOU) on devices of which these wireless phones are but one example. These updated security and connection controls are in place to address risks related life safety, information security, personal privacy and IT system integrity. The FCC restrictions continue to warn against the use of "non-regulated radio / wireless based equipment in safety of life locations and functions." Of note, these controls are intended to prevent use of these devices in areas especially where a code-blue announcement might occur, yet our devices have been used in such areas for over 10 years and so far has not prevented a code-blue announcement from happening.

Because the Facility does not have a near-term alternative to the current wireless phones, it now faces a set of competing risks. On the one hand are the risks of privacy, connection and interference or security breach(s) that are behind the controls in place for these devices. On the other hand are risks to patient safety if the current phones were to fail and telemetry nurses would lose the ability to rapidly communicate with nurses at the bedside. Our Facility does have a Life Safety approved Nurses Call / Code Blue hardwired system that is installed in those affected areas as the primary Code Blue Enunciation media.

(2) SECURITY:

(a) NEC provides a proprietary scrambling algorithm that is applied to handset registration / authentication and all communications. Every time a (OEM Mdl Nr©) user enters a designated area within the systems' coverage; an automatic user authentication process is performed to confirm the device is authorized for service on the system. This information is scrambled using a proprietary coding scheme to prevent duplication. All voice conversations are also scrambled to enhance security.

(b)The (OEM Mdl Nr©) has several built in security features in each of the wireless handsets are administered through the Facility's Telephone Private Branch Exchange (PBX) administration tool; therefore, the PBX Administrator has full control over the (OEM Mdl Nr©) wireless phones, if one gets lost or stolen it can be disabled immediately. Because of this feature you cannot purchase a similar wireless phone and have it work on our network. These phones have a 50 ft radius from the Zone radio frequency (RF) transceiver; they can only be used within the hospital as there is no handoff via other cellular networks.

(c) These items are not NIST FIPS compliant; but based on the aforementioned facts, we feel patient / staff privacy and HIPAA instructions have been and will continue to be met.

(d)Our Facility will work with (OEM) and VACO's Office of Cyber Security (Name and Phone Nr) to secure the appropriate NIST FIPS certifications will allow VA to issue a Official Approvals from the onset in the IT equipment / system procurement process.

VAMC (Boise), (Idaho - 83702-4598), Unregulated FCC Equipment Use, Risk Assessment and Mitigation, Page Three

(3) RADIO FREQUENCY (RF) INTERFERENCE:

(a) (OEM) engineers provided us with extensive information on the potential for RF along with electromagnetic (EM) interference to medical equipment within our Facility from the (OEM System) Wireless radio transceivers.

Field Experience: Since introduction of the (OEM System) Wireless product in 1996, NEC has installed this system at many health care institutions across the spectrum of medical departments. In all this time there have been zero reports of either suspected or actual RF and EM interference. This includes the experience using these devices at Portland VAMC and our continued testing documentation is available for review if requested.

Potential interference called Near Field Coupling: In these cases, an EM field emanating from one device may cause another device within its field area to malfunction. Typically the distances for these fields are less than six (6) inches. In attempts to mitigate these sources of interference, standards have been put in place, namely IEC 60601. This standard calls for devices susceptible to interference to provide shielding against fields of up to three (3) Volts per Meter. In contrast, the (OEM System) wireless products are classified under the FCC Part 15 rules as Class B unlicensed devices, and as such must meet very tight restrictions regarding field emissions of a maximum of from 100 to 500 micro (ii) Volts per Meter across the band of RFs from 30 Hz to 18 GHz. Thus, any medical device even marginally meeting the IEC Standard has not had problems with any near field emissions.

Potential phenomenon known as Far Field Induced RFI: should be considered when studying RF and EM interference sources. In this case, a part of the device subject to interference (e.g., a wire, probe, or the casing itself) can inadvertently act as a receiving antenna for a signal transmitted from another device within close proximity (within 6 to 18 inches, depending on the source power levels). To realize this type of interference, the source transmitter power must be fairly strong to conduct through the inefficient nature of the unintended antenna of the receiving device, and the material acting as the antenna must be of a shape and length that matches or is a near multiple of the wavelength of the transmitted RF signal. Finally, this unintentional antenna must not have the typical shielding between it and the subject device's electronics, which if present would prevent such a received signal from causing interference. In the case of the (OEM System) Wireless transmission, which operates between 1,920 MHz and 1,930 MHz, a probe or such piece of any medical device measuring at about six (6) inches would match the wavelength of the RF carrier, and if not properly shielded from

the units electronics may indeed conduct the RF energy within. However, even in this case, one must consider the power level at the so-called antenna receiving the signal. The average output of the (OEM Mdl Nr©) handset is approximately 10 mili (m) Watts when in use. This very low power, even further reduced by the distance between any handset in use and the subject receiving equipment, considered along with the high loss of the "antenna", results in a very low probability of actual interference. These facts, along with the standard procedures of your engineering department's efforts to check the medical equipment for such shielding and filtering defects, should mitigate this potential source.

Potential interference between intentional radiators operating in the RF band. Known as either in-band or out-of-band interference, these are cases where a transmitter broadcasts a signal of significant power at the other device's receiver to either overload the receiving radio or mix with the subject's transmitted signal to cause an interfered signal to be received. In-band interference

VAMC (Boise), (Idaho - 83702-4598), Unregulated FCC Equipment Use, Risk Assessment and Mitigation, Page Four

in the Unlicensed PCS band of which the (OEM System) Wireless system operates is prevented by the FCC rules requiring our equipment to monitor the carrier on which a device intends to transmit on before doing so, so as to sense any current use by another device. If such a signal is received during monitoring, we move to another carrier and try again. This protocol has been demonstrated many times within the FCC labs as well as at many industry trade shows where 5 or more vendors with U-PCS devices have operated in booths close to each other without interference. As for out-of-band interference, because of the extremely low power our devices operate with and the very strict out-of-band emission requirements placed upon the U-PCS devices, and the additional factor of a wide separation in the operating frequencies of our system and the typical radio telemetry equipment used in many hospital environments, such interference is very remote and would require extremely close proximity of the two devices.

All of our (OEM Mdl Nr©) are FCC listed and has not interfered with other traffic within the same band. We expect the FCC listed (OEM Mdl Nr©) equipment will perform in the same manner.

(b) Our Facility will work with (OEM) and VACO's Spectrum Management (0050P2H3) to find a RF band that can be utilized for this operation that will allow VA to issue a formal and Official Radio Use Permit that will negate the "unregulated equipment use" issues.

(4) CONNECTION TO IT/CABLE NETWORKS:

(a) Each item or system that attaches to a VA IT Network (telephone or data) must be Department of Commerce's National Recognized Testing Laboratory (NRTL) Underwriters Laboratory (UL) 60950-1/2; Information Technology Equipment - Safety listed and bears UL's mark.

1) Paragraph 1.1.1; Equipment Covered by this Standard specifically identifies these systems / networks as one affected system.

2) Paragraph 1.1.2; Additional Requirements further identifies this requirement for electomedical applications with physical connections to the patient be met.

This requirement is paramount since the Facility's Telephone PABX and associated system is listed by the National Fire Protection Association as Critical Service. Additionally, since it carries our Code Blue Radio and Overhead Audio Paging Signals, VA elevates it to Life Safety Service.

Presently the (OEM Mdl Nr©) wireless phones are UL Listed but does not have the aforementioned specific UL certification. Our Facility is working with (The OEM) in this arena to have them meet or exceed this UL requirement. In the meantime we will abide within the confines outlined in the attached MOU for insuring an approved IT Network / System connection is maintained until the appropriate UL certification has been obtained allowing it to be directly connected to our telephone system.

b. The Facility Director after careful review of the attached MOU and consultation with the Facility's CIO, (OEM) engineers, Biomedical and NFPA Engineers, ISO, HIPAA / Privacy Officer, Clinical Staff and JACHAO Officials has decided this risk-benefit analysis strongly favors purchasing replacement (OEM Mdl Nr) phones.

VAMC (Boise), (Idaho - 83702-4598), Unregulated FCC Equipment Use, Risk Assessment and Mitigation, Page Four

2. Please feel free to contact me concerning the contents of this document.

DIRECTOR'S NAME IN CAPS

cc: Office of General Consul
Office of Telecommunications (05)
VA Enterprise Infrastructure Engineering
Telecommunications Engineering and Design
Office of Cyber Security

Attachment: VACO MOU

- - - E N D - - -

THIS PAGE INTENTIONALLY LEFT BLANK

SECTION 27 52 41
PATIENT WANDER PREVENTION SYSTEM

PART 1 - GENERAL

1.1 SECTION SUMMARY

- A. The purpose of this document is to specify the Guide Specifications and Bid Criteria for the design, supply, installation, commissioning, and associated training for a Patient Wander Prevention system.

1.2 WARRANTY

- A. The installed equipment, not including Tags or consumables shall be warranted by the manufacturer to be free of defects in material and workmanship for a period of one (1) year from date of shipment from the factory.

1.3 REFERENCES

- A. Underwriters Laboratories Standard
 - ITE UL 60950, #E218113
 - ALVY UL 294 PB 4982
- B. Canadian Standards Association
 - CSA-C22.2 NO. 60950-00
 - CSA-C22.2 No. 601.1 -M90
- C. National Electrical Code

1.4 SYSTEM DESCRIPTION

The System shall be composed of the following components:

- A. Door Controller kit comprised of the following sub-components
 - Door Controller
 - Exciter antenna
 - Exciter antenna cable
 - Receiver antenna
 - Door contact
 - Door contact cable
 - Access Keypad
 - Keypad Cable
- B. Receivers comprised of the following sub components:
 - Receiver
 - Receive antenna

C. Server Computer comprised of the following sub components:

- PC (monitor not included)
- Network Manager
- Server Software
- One-year Software Maintenance Agreement
- Complete Configuration

F. I/O-8 Module

G. Central Power Supply

H. RS-485 Communication network

I. Ethernet network

J. Tags

- Wrist Tag with Tag Pulse
- Wrist Tag without Tag Pulse
- Asset Tag
- Pendant Tag
- SB Tag

K. Pocket Tag Reader (Tag configuration and test tool)

L. Tag Rack

1.5 SYSTEM OPERATION

Door Controller Kits: The system shall create a perimeter around the protected area using Door Controller Packs at each of the egress points. The Door Controller packs detect Tags worn by residents/patients or attached to Assets, and upon detection may perform any or all of the functions described in Sec. 2.17.

Receivers: Receivers shall be placed at specified intervals within the protected perimeter to receive signals generated by the Tag as described in 2.19.

Application Software (Server software): Application Software and central database shall reside on the Server Computer. The Server receives status information from the Door Controllers and Receivers via an RS-485 Network. The Server also provides an Ethernet network connection to the central monitoring console. All of the functions of a client Workstation are available at the Server, which may be used on a day-to-day basis by the user. Specific Software features and functions are described in Sec. 2.6- 2.14.

Remote Application Software (Remote License): Remote Application Software and a secondary database shall reside on each of the Workstation Computers. The workstation computers shall allow the user to access the remote software capabilities of the system. Administrative account access is restricted to the server PC only.

I/O-8 Module: The I/O-8 Module shall provide transistor connections that allow external relays to be used to enable the integration of other manufacturers' equipment into the System.

Central Power Supply: A Central Power Supply shall provide eight (8) eight independent, fuse protected, 24 VDC trigger controlled outputs.

RS-485 Network: An RS-485 Network shall be used to communicate Door Controller and Receiver status to a server computer.

Ethernet Network: An Ethernet Network shall be used to communicate data between the Server and the Workstations. The computers shall communicate via TCP/IP.

Wrist Tag with Tag Pulse: Wrist Tags worn by residents/patients shall be detected by the Door Controllers placed at each egress point, generating a Wander alarm. The Tag shall also indicate a low battery condition 30 days prior to the Tag becoming inoperative due to a low battery. The Wrist Tag shall emit a Tag Pulse every 16 seconds to enable the system to fully supervise the Tag. The system shall alarm if the Tag Pulse is not received by the system. The Wrist Tag shall be constructed of a high impact plastic that is easily cleaned. The Wrist Tag shall carry a one-year warranty.

Wrist Tag without Tag Pulse: Wrist Tags worn by residents shall be detected by the Door Controllers placed at each egress point, generating a Wander alarm. The Tag shall also indicate a low battery condition when brought into the field of a protected egress point 30 days prior to the Tag becoming inoperative due to a low battery. The Wrist Tag shall be constructed of a high impact plastic that is easily cleaned. The Wrist Tag shall carry a three-year warranty.

Asset Tag: Asset Tags shall be detected by the Door Controllers placed at each egress point. The Tag shall also indicate a low battery condition 30 days prior to the Tag becoming inoperative due to a low battery. The Tag shall create a Tag Pulse at 16-second intervals to enable the system to fully supervise the Tag. The system shall alarm when the Tag Pulse is not received by the system. The Asset Tag shall carry a three-year warranty.

Pendant Tag: The Pendant Tag shall have two compatible functions: to be worn by hospital staff and employees to enable automatic bypass of Door Controllers placed at each egress point; and to enable staff or residents/patients to call for assistance from anywhere within the coverage area. The Pendant Tag shall be usable for real-time locating in a receiver-based system. The Pendant Tag shall carry a one-year warranty.

Pocket Tag Reader: The Pocket Tag Reader shall test all types of Tags and display the electronic serial number and battery status. The Pocket Tag Reader shall have capabilities to test field strength and function as a diagnostic tool for technicians and installers of the system.

Tag Rack: The Tag Rack shall store up to 42 Tags. Tags shall have their pulse disabled while in the Tag rack so as to conserve battery life. PART

2 - PRODUCT / DESCRIPTION

2.1 COMPONENT QUANTITIES

A. The quantities of components shall be determined and installed by the contractor based on the requirement to provide a fully operational wander prevention system as per the intent of the specific application as shown on the shop drawings and as recommended by the manufacturer.

2.2 SERVER COMPUTER

The Server Computer shall be IBM Compatible with the following specifications or better:

CPU shall be a minimum of Intel® Celeron®, 3.0 GHz

RAM shall be a minimum of 2 GB

Hard Disk shall be a minimum of 100GB

CDR/W shall be 52x24x52

Ethernet card shall be 100/1000BaseTX

Operating System shall be Windows XP Professional SP3

Warranty period is administered by the computer manufacturer

2.3 WORKSTATION COMPUTER (CONSOLE)

The Workstation Computer shall be IBM Compatible with the following specifications or better:

CPU shall be an Intel® Celeron®, 2.2 GHz

RAM shall be 256 MB

Hard Disk shall be 40GB

CDR/W shall be 52X24x52

Ethernet card shall be 100/1000BaseTX

Operating System shall be Windows XP Professional SP3

G. Warranty period is administered by the computer manufacturer

2.4 ETHERNET LAN

An isolated 100Mb Ethernet Local Area Network shall be constructed by the Owner in order for the Server and Workstation computers to communicate utilizing Dynamic TCP/IP protocol.

2.5 RS-485 NETWORK

An isolated RS-485 Network shall be constructed utilizing proper RS-485 communications cable, the rating of which adheres to Code. Door Controllers, Receivers, I/O 8 Modules and all other potential family RS-485 devices shall be connected in this network adhering to RS-485 protocols. This network shall be interfaced to the Server.

2.6 SERVER SOFTWARE

The Server Software shall have three levels of security, User, Supervisor and Administrator, each protected by user names and passwords. The capacity shall be 1000 users. In addition to the functions listed under the pertinent section below, the User screen shall provide the following features:

Graphical Floor Plan, displayed prominently on the screen. The floor plan shall be stored on the Server hard disk, in a bitmap format.

Mode Indication, indicating the current mode the software is operating in: User, Supervisor or Administrator.

Assigned Tag Count

Unassigned Tag Count

Day/Date/Time

Number of active alarms

Device Icons shall indicate the location of all Door Controllers,

Elevator Controllers, Receivers, and I/O-8 Modules when in an alarm state. The Server and Workstation icons are displayed at all times.

Active Alarm Indication shall be displayed on the Graphical Floor Plan, using separate icons to differentiate between Wrist Tags, Pendant Tags and Asset Tags. An alarm identifier shall appear as a text description of the alarm, indicating the location of the device (Door Controller, Elevator Controller, I/O-8 Module or Receiver), the name of the resident/patient, and the date and time of the alarm event. The alarm event shall also be indicated by a user defined sound, stored on the Hard Disk as a .wav file. Separate sounds may be configured for Wrist Tags and Asset Tags.

2.7 USER MODE FUNCTIONALITY

The User Mode shall require a User Level password and user name in order to access the following functions:

The Admit feature shall be accessible via a single-click button on the User Screen. When the Admit button is selected an Admit Wizard shall guide the user through the process of associating Wrist Tags and Asset Tags to their respective resident/patient or asset. Tags which are currently associated to residents/patients or assets will not be selectable in this screen to prevent Tags being associated with more than one resident/patient or asset.

The Discharge feature shall be accessible by a single-click button on the User Screen. When the Discharge Button is selected a Discharge Wizard shall guide the user through the process of disassociating the Tag from the resident/patient or asset. Tags which are not associated to a resident/patient or asset will not be available in this wizard.

The Accept Alarm feature shall be accessible by a single-click button on the user screen. As an alternative, the alarm may be selected by double-clicking the text description of the alarm. In either case, the Accept Alarm wizard shall guide the user through the process. When an alarm is accepted a note must be entered into the wizard to describe the details of the alarm. This note may be selected from a drop down menu box with pre-defined annotations that are customizable by each facility. The drop down annotations are defined by a supervisor in the Supervisor Mode, see Sec. 2.8.

The Edit button shall allow the user to edit the resident/patient or asset information without discharging and readmitting the resident/patient.

The Mute button shall allow the user to mute the alarm sound without a user name and password being entered. It is possible to disable the Mute button within the Administrator Mode if this functionality is not desired.

The Locate feature shall allow the user to locate any Tag with Tag Pulse within the protected perimeter. Upon entering the Locate function, a tree-structured list of assigned Tags organized by floor, Tag type and category will appear. A user can locate one or more Tags in the system by floor, by Tag type and by category (for Pendant and Asset Tags). The physical locations of Tag shall be indicated on the floor plan by the appropriate Tag icon.

The Transport button shall allow the user to designate a Tag for transport out of the protected perimeter. When the Transport button is selected a Transport wizard text box shall appear guiding the user through the Transport process. The transport feature shall allow the user to select a Tag for transport, assigning the Tag a specified duration of leave from the protected perimeter in fifteen minute intervals to a maximum of 72 hours. The Tag which has been selected for transport will be automatically bypassed through any of the perimeter doors during the following 15 minutes, and will then be in Transport mode for the duration selected in the Transport wizard. If the Tag is not transported through any of the doors within 15 minutes, the transport feature will be automatically cancelled. When a Tag in transport mode is returned to the protected perimeter, it must be reactivated manually.

2.8 SUPERVISOR MODE FUNCTIONALITY

The Supervisor Mode shall require a Supervisor Level password and user name in order to access the following functions as selectable tabs:

The Activity Log shall record all events, including general information, alarms, warnings, acceptance of alarms, Tag status changes, software status, communication errors, node failures, attempted security breaches, software configuration changes, console errors and system errors. The Activity Log shall have the following buttons to provide ease of use. The Activity Log shall be stored for a minimum of 30 days, configurable by the user, with the ability to backup the Activity Log to a folder on the computer network.

Date Navigator buttons to jump to the First Day, Previous Day, Next Day, and Last Day of the Activity Log.

Annotation button to annotate the Activity Log entry.

Auto Refresh button to suspend writing to the activity log while it is being used.

Activity Display Filter Setup to set up criteria for viewing events in the Activity log.

Print button to print the currently displayed Activity Log data.

2.9 ADMINISTRATION MODE FUNCTIONALITY

Administration Mode shall require an Administrator Level user name and password in order to access the following functions:

A. Settings: The Settings tab shall contain the following user configurable checkbox options:

Filter Door Events shall cause each door open and close event to be written the activity log.

Show Noise Status shall cause RF noise status events to be displayed.

Nurse Saver Mode shall suppress Exit alarms when the door is closed and there is no danger of a Tag exiting the protected perimeter.

Use Screen Saver shall display a screen saver after five minutes of user inactivity.

Show Floor Plan Icons shall cause floor plan icons to be hidden until an alarm associated with the associated device takes place.

Use Small Icon Size shall cause floor plan icons to be displayed at a smaller size to aid viewing of floor plans with many icons.

Alarm On Unassigned TIF shall display TIF alarms from Tags that are stored improperly.

Enable Mute Button shall enable users to access the Mute button.

Warn on Tag Not in Inventory shall select the option of displaying a warning when a Tag is seen that is not in the Tag database.

Multi Floor TIC Discriminator, shall select the option of displaying alarms only to the floor the Tag is referenced with

Activity Log Keep Last x Days shall select how many days of the activity log to keep on file.

Backup Folder shall select the location for backup storage.

Missed Tag Pulse Actions shall select how the system responds to configured missing Tag Pulse signals.

Message Port settings shall select the serial port to connect to the system and the messaging baud rate to communicate with the Tags.

System Background Color shall provide a background color palette to select the desired color of the display properties.

Activity Log

1. The Activity log tab shall have the same properties as the Activity Log tab in Supervisor mode.

Tags

1. The Tags tab shall have the same properties as the Tags tab in Supervisor mode.

Users

1. The Users tab shall have the same properties as the User tab in Supervisor mode.

Floors

1. The Floors tab shall allow the Administrator to import floor plans from a bitmap file into the application. This tab shall also allow the user to drag and drop Door Controller, Elevator Controller, Receiver and I/O-8 Module icons onto the imported floor plans in the application.

Consoles

1. The Consoles tab shall allow the Administrator to add workstation consoles to the Ethernet network. Each console shall be configurable with the following filters: 3 Tag ID range filters, 2 Tag Type filters, and alarm suppression filters. This feature is used to partition each console to respond to the selected type of alarms, and the selected alarm zones.

Nodes

1. The Nodes tab shall allow the Administrator to add or delete Door Controller, Elevator Controller, Receiver, and I/O-8 Module devices to/from the system's database.

Links

1. The Links Tag shall allow the Administrator to add or delete and configure links. Links shall enable a logical condition to be related to an I/O 8 Module channel, configurable by the Administrator.

RS485 Network

1. The RS485 Network tab shall add or delete and configure the baud rate of any attached RS-485 network drivers.

Sounds

1. The sound notification tab shall allow the Administrator to customize alarm sounds by importing a .wav file into the application

Messaging

1. The Paging/Messaging Interface shall allow for notification of alarms to be sent directly to a messaging device such as a pager.

- Annotations
1. The Annotation tab shall allow the Administrator to add/delete preconfigured annotations to be selected by the user when accepting an alarm.

M. Categories

1. The Categories tab shall allow the Administrator to classify Tags into groups to enable the Tags to bypass specified Door Controllers without generating an alarm.

2.10 TAGS

The Tag Database shall record all Tags in the facility inventory. Each Tag shall be listed with the Tag ID, Tag status, assigned by, date time assigned and warranty expiry date. The Tag database shall have the following buttons:

Add New Tag shall initiate the Add New Tag wizard, which will guide the supervisor through the process of adding a Tag manually or using a Tag Link to automatically read the tag serial number.

Delete Tag shall delete the Tag from the Tag Database, however not the records pertaining to the Tag in the activity log.

Tag Properties shall include information containing Tag serial number, status, Tag expiry date, Tag assignment, assigning user, Tag pulse supervision, location history and Category.

Print, which shall print the Tag database list.

2.11 USERS

The Users Database shall record all users authorized to access the software. The User Database shall list Login Name, Full Name, Access group, Status, Assigning user, Date/Time assigned. The User Database shall have the following buttons:

Add New User shall initiate the Add New User wizard, which will guide the Supervisor through the process of adding a new user.

Delete User shall allow the Supervisor to delete a current User with an equal or lower access level.

Properties shall display the properties of the user including: Login name, Full name, Password (hidden), PIN code, Access rights, and a checkbox to disable login for that user.

Print, which will print the user list.

2.12 ANNOTATIONS

The Annotations database shall provide the user with automatic alarm annotation entries. The Annotations database shall have the following buttons:

- A. Add New Annotation shall enable the Supervisor to add new annotations, which will be made available in a drop down list to the user when an alarm is acknowledged.

Delete Annotation shall allow the Supervisor to delete the Annotation. Properties shall allow the Supervisor to view or edit the Annotation.

2.13 TAG CATEGORIES

The system is capable of providing customized levels of access for residents/patients of different cognitive ability. The Tag Categories shall allow for organizing Tags into groups to enable Tag groups to bypass specified Door Controllers without generating an alarm.

Add New Tag Category shall allow for defining and configuring a Tag class for Tags.

Delete Tag Category shall allow the Supervisor to delete a Tag Category.

Properties shall allow the Supervisor to view and edit the Tag Category.

2.14 NOTIFICATION TO MESSAGING DEVICES

The system shall be capable of automatically forwarding alarm notifications to messaging devices such as pagers. This feature has the following sub-components:

Pager View shall list all configured messaging devices and include: device ID, notification events, console and optional notes.

Add New Messaging Device shall invoke the Messaging Device Wizard, which will guide the user through the addition of a new messaging device.

Notification events that can be sent to messaging devices includes:

Notify on Exit Alarm, Notify on Duress Alarm, Notify on Alarm

Acceptance, and Notify on a Communication Alarm. The

workstation/console from where the notification events are generated is also selected.

Delete Messaging Device shall invoke the Delete Messaging Device Wizard, which will guide the user through the deletion of a messaging device.

Properties shall allow the properties of the messaging devices to be edited including the notification events to be sent to a specific messaging device and the workstation/consols from which the notifications will be generated.

Print shall allow a hardcopy print out of the Pager View.

2.15 WORKSTATION SOFTWARE

Workstation software shall be installed at each workstation. The software features are identical to the User and Supervisor mode features on the Server. For security purposes Administration mode shall not be available on workstations to prevent unauthorized changes to system parameters.

2.16 ALARM OUTPUT MODULE

The Alarm Output Module shall connect to either the Server or Workstation RS-232 serial port. The Alarm Output Module shall incorporate 2 Form-C relay outputs, one to notify on TIF and the other to notify on TIC.

2.17 DOOR CONTROLLERS

The Door Controller shall be mounted at each egress point to detect Tags attempting to exit the protected perimeter. The Controller shall also detect Tag initiated communication messages such as Duress alarms and low battery signals. The Controller shall communicate all Tag messages and Controller status to the Server. The Controller shall also provide audible and visual indicators via local alarm annunciation devices, which shall include an Access Keypad mounted near the egress point. The Door Controller circuit board shall consist of a 433.9 MHz receiver to receive signals from the Tags, and a 307 kHz transmitter to send information to the Tags.

Standalone Operation

1. This Door Controller shall be fully capable of operating in stand-alone mode in the event of loss of communication with the Server.

Front Panel Connections

1. The front panel shall provide easy access to a number of different output formats as well as allowing inputs to alter some of its automatic functions as necessary.

Input Voltage: The Controller shall operate on 24 VDC rated at 1.5 A, including current required to operate the maglock.

RS-485: The Controller shall have an RS-485 connection to communicate information to the Server.

Wiegand Output: The Tag IDs and status as well as Controller serial number and status information shall be output in Wiegand format on 2 of the output pins.

Door Switch Input: The Controller shall use the Door Switch input to disable alarm reporting when the door is closed. This is known as the Nurse Saver Feature. Although Tags are still detected and reported to the Server, no alarms shall be

annunciated until the door opens. At that time, all the Tags are re-read by the Controller so that only the Tags that are still in the field will cause an alarm. The door switch is also useful during bypass as the controller will detect the door opening and then terminate the bypass as soon as the door closes. In the event that a Tag is detected at the door with the door being closed, and the Tag remains at the door for a period exceeding 55 seconds, a Loiter alarm is created.

Override In: Override In shall disable the Door Controller exciter field in order that no Tags are read and no Exit or Loiter are reported to the console. Shorting the Override In line to system ground will activate this function. The Override In shall ignore Duress alarms, Low Battery alarms, or Tag Pulse messages from the Tag.

Unlock In: Unlock In provides a temporary release of the door, by dropping the Mag Out voltage to zero, for a maglock override such as that from a fire alarm control. New alarms and messaging are still allowed.

Alarm In: Alarm in will cause an immediate lockup of the door with the local and remote alarm annunciators on.

Maglock Output: The MagOut line shall supply a minimum of 1A at 24 VDC to a magnetic door lock when Tags are detected in the field.

Auxiliary Relay Outputs: The Controller shall provide 2 Form-C dry relay contacts. Relay 1 will activate on TIF and door open, or Loiter, if selected. Relay # 2 is configurable for activation on TIF, TIC, or bypass.

Front Panel Indicator: This indicator shall be solid red in stand-alone mode. In a networked system, the indicator shall be solid green to indicate normal communications, and alternate red/green to report communications failure.

Internal Mode Switch: An internal mode switch shall provide the Controller the following function Responses:

Test Mode used for Exciter Field set-up

Latched or unlatched alarm options

Relay #2 configuration for activation on TIF, TIC, or Bypass.

4. Exciter Antenna Status Alarm: The Controller shall have the ability to detect the status of the Exciter Antenna and report a problem to the Server in the event it senses either of the following:
 - SRA Exciter Antenna is disconnected from the Controller
 - The Exciter Field is significantly turned down ($< 4.5V$) to the point where an exciter field hardly exists.
5. Physical Installation: The Door Controller shall be designed for surface wall or shelf mounting. All wiring to and from the Door Controller shall be terminated on a plug-in, polarized terminal strip so that wiring remains intact should Door Controller replacement become necessary. The Door Controller housing shall be constructed of zinc dichromate plated steel with a flip top lid for easy access. The Door Controller shall require a 24 VDC power source and shall be connected to a surge-protected emergency generator circuit if available.
6. The Receiver Circuit shall have the following functions:
 - Threshold / RX Sensitivity Switch (R3 Receiver only): The Threshold switch may be adjusted to increase or reduce the sensitivity of the Receiver and therefore the range of detection of Tags. It is also used to remove some of the background RF noise on the radio channel if the Controller is having trouble detecting Tags. The adjustment raises the RF field strength required for Tags to trigger the Controller into alarm, and reduces the detection field range. Maximum sensitivity is "9," and minimum sensitivity is "1." Setting to "0" turns the Receiver input OFF.
 - Threshold / RX Sensitivity (R4 Receiver only): R4 Receivers are autosensing for maximum range.
 - Receiver Activity Indicator: The Receiver Activity Indicator shall blink briefly when valid data is received by the Controller. Continuous activation indicates the presence of RF noise. No indication signifies that the receiver section is not operational.
7. Exciter Antenna: The Exciter Antenna shall be designed for surface wall, ceiling, or floor mounting, or concealed within the ceiling or wall structure of the area to be protected. The antenna wiring shall consist of a factory prepared 7.5 meter (25 foot) RG59U coaxial cable with BNC connectors from the antenna to the Door Controller. A

single Exciter Antenna shall have a field range of approximately 10 feet. Two antennae connected to the Door Controller shall have a range of 16 feet.

2.18 RECEIVERS

The Receiver shall receive the Duress alarm, Low Battery or Tag Pulse Message from the Tag at 433 MHz and report the status to the Server. The Receiver shall be powered by 24 VDC. Status indicators shall indicate RF activity, power and network status.

2.19 I/O-8 MODULE

The I/O-8 Module shall be connected to the rest of the system via the RS-485 network. The user shall be able to configure each of the 8 ports as an input or output from the server, as follows.

A. Input Zone

Two types of inputs shall be configurable at the Server:

Latching Input: The Server shall report an alarm when the zone is in alarm, and will remain in alarm condition until the zone input returns to the normal/default state and the user accepts the alarm.

Non-Latching Input: The Server shall report the alarm as long as the zone is in alarm and will automatically clear the alarm when the input condition returns to normal/default state.

Every Input Zone shall be configured to have a certain default input state. An input zone is said to be in alarm when the input condition is other than this default state. The two basic states shall be:

Normally Closed (NC): The normal state is when the zone contact is closed and an alarm is generated when the zone contact opens

Normally Open (NO): The normal state is when the zone contact is open and an alarm is generated when the zone contact closes

The Input Zone shall be configurable as a Supervised or Non-Supervised zone depending on whether an end-of-line termination resistor is installed at the input zone. Configuring the zone as a Supervised zone will help to detect

whether the input switch is being tampered with, i.e. if the switch is hard-wired or open circuited.

B. Output Zone

The Output Zone shall be controlled by the Links feature at the Server. Links allows the user to link the occurrence of one or more predefined conditions such as time, input zone conditions, Exit alarm or Communication Failure alarm to act as a trigger (Link Trigger) which

causes the system to carry out certain operations (Link Action) on one of the output zones specified during Link setup. A link can be triggered in one of three ways:

Time and Day triggered: Link actions are carried out during the Link ON period.

Alarm trigger: Link actions are carried out anytime the Link trigger condition is met.

Combination of 1 and 2 above: Link actions are carried out when the Link trigger condition is met during the Link ON period.

When a Link is active (all the trigger conditions are met), the link action causes the output state on the selected output zone to change from the normal state to the opposite state.

2.20 CENTRAL POWER SUPPLY

The Central Power Supply shall have 8 independent, fuse protected 24 VDC 1.25A outputs with a total current capacity of 10 A, supplied with a line voltage of 115 VAC. A fire alarm input shall be provided which will switch off power to four, or eight, outputs to deactivate maglocks. A Form-C relay output enables alarm monitoring, or trigger to other auxiliary devices. A battery backup shall provide continuous power to all devices in the case of a power failure.

2.21 TAGS

Tags shall be of the "semi-active" type, operating at a frequency of 433.9 MHz. Tags shall be water-resistant. Each Tag shall have a unique ID number, with the serial number visible on the surface. Tag weight shall be 1/3 ounce (9 grams) or less. All Tags shall carry a one-year warranty, with the exception of the Asset Tag and Wrist Tag without Tag Pulse, which shall have a three-year warranty. Four types of Tags shall be available:

A. Wrist Tag with Tag Pulse

B. The Wrist Tag with Tag Pulse shall be a semi-active Tag that sends the following information wirelessly to the system:

Exit Alarm (Tag in Field (TIF)): generated when the Tag enters a Door Controller's exciter field.

Tag Pulse (Tag Locating Message (TLM)): regular signal generated every 16 seconds to indicate proper functionality.

Low Battery message: sent when Tag has 30 days of life remaining.

C. Wrist Tag without Tag Pulse

The Wrist Tag without Tag Pulse shall be an active Tag that sends the following information wirelessly to the system:

Exit Alarm (Tag in Field (TIF)): generated when the Tag enters a Door Controller's exciter field.

Low Battery message: sent when Tag has 30 days of life remaining.

D. Pendant Tag

The Pendant Tag shall be an active Tag that sends the following information wirelessly to the system:

Tag in Field (TIF) message: if enabled, shall cause exit doors to automatically unlock when the Tag enters a Door Controller's exciter field.

Tag Pulse (Tag Locating Message (TLM)): regular signal generated to indicate proper functionality. Configurable from 16 second to 24 hour interval.

Duress Alarm: generated when the button on Pendant Tag is pressed.

Low Battery message: sent when Tag has 30 days of life remaining.

E. Asset Tag

The Asset Tag shall be an active Tag that sends the following information wirelessly to the system:

Exit Alarm (Tag in Field (TIF)): generated when the Tag enters a Door Controller's exciter field.

Tamper Alarm (Tag Initiated Communications (TIC)): generated when the tamper circuit has been activated (i.e. the Tag is removed from an asset).

Beacon Signal (Tag Locating Message (TLM)): regular signal generated to indicate proper functionality. Configurable from 16 second to 24 hour interval.

Low Battery message: sent when Tag has 30 days of life remaining.

2.22 POCKET TAG READER

The Pocket Tag Reader shall be battery operated with a backlit LCD screen for reading, testing and configuring tags. It shall display Tag electronic serial number and provide quick Pass/Fail indication for evaluating Tag performance and enabling/disabling Tag Pulse signals. It shall also enable and disable TIF on Pendant Tags. Furthermore, the configuration tool shall provide technical functionalities for reading, testing and configuring tags, as well as analyzing system and field parameters. The device also shall have its own internal low battery indication.

2.23 TAG RACK

The Tag Rack shall provide a central storage cabinet that helps to extend the battery life of Wrist Tags. The metal Tag Rack cabinet shall be wall-mountable and easily cleaned. The Tag Rack door shall be left-hand opening and can be fitted with an optional lock for additional security. Labels shall be provided to record Tag serial numbers with specific Tag Rack locations. Each Tag rack shall accommodate up to 42 Tags.

PART 3 - EXECUTION

3.1 CONTRACTOR QUALIFICATIONS

The Contractor shall hold all necessary permits or licenses required by city, state and national regulations.

A copy of all such permits or licenses must be posted on site prior to, and during execution.

The Contractor shall employ a minimum of one qualified technician holding a certified training certificate from the manufacturer.

3.2 GENERAL INSTALLATION

The Contractor shall ensure that all system components are installed as per the equipment manufacturer's specifications.

The Contractor shall ensure all system components and wiring are installed in compliance with all local, state, or national codes in effect.

A minimum of one qualified technician holding a certified training certificate from the manufacturer shall be involved in the installation.

3.3 SITE MANAGEMENT RESPONSIBILITY

The Contractor shall provide an on-site project manager who is responsible for all aspects of the system installation.

3.4 CHANGES

Prior to proceeding with any changes or claims for project extras, the Contractor shall provide written notice, and secure prior approval from the Customer, and substantiate actual costs of each change or claim. The cost of each change shall be based upon the unit price list and cost breakdowns provided with the bid response.

3.5 SYSTEM COMPONENTS

A. Prior to the delivery to the site for actual installation, all devices or requested sub-systems shall be assembled in the manufacturer's facility and shall be fully tested and any software configuration shall be performed at this time.

B. The Contractor shall record all serial numbers and provide a copy to the Customer.

3.6 POWER REQUIREMENTS

The Contractor shall identify all power sources and mark the appropriate breakers with the system device identity and location. The Contractor shall provide a backup power system for critical components in the event of a power failure and provide UPS power if required. For the system PCs the contractor shall provide UPS power sufficient to sustain power to the PCs, monitors, printers and peripheral equipment for up to ten minutes.

3.7 CABLE AND WIRE

All wire and cable shall be tied down and terminated and conform to all local, state, or national codes. All cable must meet the network specifications for which they are deployed (e.g. RS-485, TCP/IP). After installation and prior to termination the Contractor shall check all wire and cable for grounds, shorts and open circuits on any conductors or shields.

The Contractor shall visually inspect all wire and cable runs for bends or kinks less than the recommended radius as recommended by the cable manufacturer. Grommets and strain relief shall be provided where necessary.

All wire, cable and terminal blocks shall be identified by labels, Tags or other permanent markings. The markings shall clearly identify the function, source and destination of all cabling, wiring and terminals

3.8 PREPARATION PRIOR TO SITE COMMISSIONING

All system components shall be fully installed, and operational. Any components that require adjustment or tuning shall be fully adjusted and tuned.

All work areas shall be cleaned and clear of debris.

All necessary patching and painting shall be complete.

All extra materials and spares shall be delivered and properly stored on site.

Test, tuning and adjustment data shall be recorded and delivered to the Customer, as built drawings are completed and made ready for inspection.

3.9 SITE COMMISSIONING

Site Commissioning shall be performed by a manufacturer representative or manufacturer-trained contractor. A site commissioning report shall be delivered to the Customer prior to System Acceptance.

3.10 AS BUILT DRAWINGS, SITE DOCUMENTATION

The Contractor shall provide 2 copies of As Built Drawings to the Customer.

The Contractor shall provide copies of all user documentation and manuals to the Customer.

3.11 IN-SERVICE TRAINING

The Contractor shall supply at least 30 minutes of In-Service Training, performed by factory trained personnel.

In-Service Training shall be coordinated with the Customer representative of Nursing and shall include all staff associated with the wander prevention system.

3.12 SYSTEM ACCEPTANCE

Acceptance of the system shall require a demonstration of the system performance, reliability, and proof of proper operation of all components.

All Documentation must be delivered as described in Sec 3.10, 3.11 -

- - E N D - - -

SECTION 28 05 11
REQUIREMENTS FOR ELECTRONIC SAFETY AND SECURITY INSTALLATIONS

PART 1 - GENERAL

1.1 DESCRIPTION

This Section, Requirements for Electronic Safety and Security Installations, applies to all sections of Division 28.

Furnish and install electronic safety and security cabling, systems, equipment and accessories in accordance with the specifications and drawings. Capacities and ratings of, cable and other items and arrangements for the specified items are shown on drawings.

1.2 MINIMUM REQUIREMENTS

References to industry and trade association standards and codes are minimum installation requirement standards.

Drawings and other specification sections shall govern in those instances where requirements are greater than those specified in the above standards.

1.3 QUALIFICATIONS (PRODUCTS AND SERVICES)

A. Manufacturers Qualifications: The manufacturer shall regularly and presently produce, as one of the manufacturer's principal products, the equipment and material specified for this project, and shall have manufactured the item for at least three years.

B. Product Qualification:

Manufacturer's product shall have been in satisfactory operation, on three installations of similar size and type as this project, for approximately three years.

The Government reserves the right to require the Contractor to submit a list of installations where the products have been in operation before approval.

C. Service Qualifications: There shall be a permanent service organization maintained or trained by the manufacturer which will render satisfactory service to this installation within four hours of receipt of notification that service is needed. Submit name and address of service organizations.

1.4 MANUFACTURED PRODUCTS

Materials and equipment furnished shall be of current production by manufacturers regularly engaged in the manufacture of such items, for which replacement parts shall be available.

When more than one unit of the same class of equipment is required, such units shall be the product of a single manufacturer.

C. Equipment Assemblies and Components:

Components of an assembled unit need not be products of the same manufacturer.

Manufacturers of equipment assemblies, which include components made by others, shall assume complete responsibility for the final assembled unit.

Components shall be compatible with each other and with the total assembly for the intended service.

Constituent parts which are similar shall be the product of a single manufacturer.

D. Factory wiring shall be identified on the equipment being furnished and on all wiring diagrams.

E. When Factory Testing Is Specified:

The Government shall have the option of witnessing factory tests. The contractor shall notify the VA through the COTR a minimum of 15 working days prior to the manufacturers making the factory tests. Four copies of certified test reports containing all test data shall be furnished to the COTR prior to final inspection and not more than 90 days after completion of the tests.

When equipment fails to meet factory test and re-inspection is required, the contractor shall be liable for all additional expenses, including expenses of the Government.

1.5 EQUIPMENT REQUIREMENTS

Where variations from the contract requirements are requested in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES, the connecting work and related components shall include, but not be limited to additions or changes to branch circuits, circuit protective devices, conduits, wire, feeders, controls, panels and installation methods.

1.6 EQUIPMENT PROTECTION

- A. Equipment and materials shall be protected during shipment and storage against physical damage, dirt, moisture, cold and rain: During installation, enclosures, equipment, controls, controllers, circuit protective devices, and other like items, shall be protected against entry of foreign matter; and be vacuum cleaned both inside and outside before testing and operating and repainting if required. Damaged equipment shall be, as determined by the Resident Engineer, placed in first class operating condition or be returned to the source of supply for repair or replacement.

Painted surfaces shall be protected with factory installed removable heavy kraft paper, sheet vinyl or equal.

Damaged paint on equipment and materials shall be refinished with the same quality of paint and workmanship as used by the manufacturer so repaired areas are not obvious.

1.7 WORK PERFORMANCE

Job site safety and worker safety is the responsibility of the contractor.

For work on existing stations, arrange, phase and perform work to assure electronic safety and security service for other buildings at all times. Refer to Article OPERATIONS AND STORAGE AREAS under Section 01 00 00, GENERAL REQUIREMENTS.

New work shall be installed and connected to existing work neatly and carefully. Disturbed or damaged work shall be replaced or repaired to its prior conditions, as required by Section 01 00 00, GENERAL REQUIREMENTS.

Coordinate location of equipment and conduit with other trades to minimize interferences.

1.8 EQUIPMENT INSTALLATION AND REQUIREMENTS

Equipment location shall be as close as practical to locations shown on the drawings.

Inaccessible Equipment:

Where the Government determines that the Contractor has installed equipment not conveniently accessible for operation and maintenance, the equipment shall be removed and reinstalled as directed at no additional cost to the Government.

"Conveniently accessible" is defined as being capable of being reached without the use of ladders, or without climbing or crawling under or over obstacles such as, but not limited to, motors, pumps, belt guards, transformers, piping, ductwork, conduit and raceways.

1.9 EQUIPMENT IDENTIFICATION

Install an identification sign which clearly indicates information required for use and maintenance of equipment.

Nameplates shall be laminated black phenolic resin with a white core with engraved lettering, a minimum of 6 mm (1/4 inch) high. Secure nameplates with screws. Nameplates that are furnished by manufacturer as a standard catalog item, or where other method of identification is herein specified, are exceptions.

1.10 SUBMITTALS

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. The Government's approval shall be obtained for all equipment and material before delivery to the job site. Delivery, storage or installation of equipment or material which has not had prior approval will not be permitted at the job site.
- C. All submittals shall include adequate descriptive literature, catalog cuts, shop drawings and other data necessary for the Government to ascertain that the proposed equipment and materials comply with specification requirements. Catalog cuts submitted for approval shall be legible and clearly identify equipment being submitted.
- D. Submittals for individual systems and equipment assemblies which consist of more than one item or component shall be made for the system or assembly as a whole. Partial submittals will not be considered for approval.

Mark the submittals, "SUBMITTED UNDER SECTION _____".
Submittals shall be marked to show specification reference including the section and paragraph numbers.

Submit each section separately.

- E. The submittals shall include the following:
 - Information that confirms compliance with contract requirements.
 - Include the manufacturer's name, model or catalog numbers, catalog information, technical data sheets, shop drawings, pictures, nameplate data and test reports as required.
 - Elementary and interconnection wiring diagrams for communication and signal systems, control system and equipment assemblies. All terminal points and wiring shall be identified on wiring diagrams.
 - Parts list which shall include those replacement parts recommended by the equipment manufacturer, quantity of parts, current price and availability of each part.
- F. Manuals: Submit in accordance with Section 01 00 00, GENERAL REQUIREMENTS.
 - 1. Maintenance and Operation Manuals: Submit as required for systems and equipment specified in the technical sections. Furnish four copies, bound in hardback binders, (manufacturer's standard binders) or an approved equivalent. Furnish one complete manual as specified in the technical section but in no case later than prior to performance of

systems or equipment test, and furnish the remaining manuals prior to contract completion.

Inscribe the following identification on the cover: the words "MAINTENANCE AND OPERATION MANUAL," the name and location of the system, equipment, building, name of Contractor, and contract number. Include in the manual the names, addresses, and telephone numbers of each subcontractor installing the system or equipment and the local representatives for the system or equipment.

Provide a "Table of Contents" and assemble the manual to conform to the table of contents, with tab sheets placed before instructions covering the subject. The instructions shall be legible and easily read, with large sheets of drawings folded in.

The manuals shall include:

Internal and interconnecting wiring and control diagrams with data to explain detailed operation and control of the equipment.

A control sequence describing start-up, operation, and shutdown.

Description of the function of each principal item of equipment.

Installation and maintenance instructions.

Safety precautions.

Diagrams and illustrations.

Testing methods.

Performance data.

Pictorial "exploded" parts list with part numbers. Emphasis shall be placed on the use of special tools and instruments. The list shall indicate sources of supply, recommended spare parts, and name of servicing organization.

Appendix; list qualified permanent servicing organizations for support of the equipment, including addresses and certified qualifications.

Approvals will be based on complete submission of manuals together with shop drawings.

After approval and prior to installation, furnish the COTR with one sample of each of the following:

A 300 mm (12 inch) length of each type and size of wire and cable along with the tag from the coils of reels from which the samples were taken.

Each type of conduit and pathway coupling, bushing and termination fitting.

Conduit hangers, clamps and supports.

Duct sealing compound.

I. In addition to the requirement of SUBMITTALS, the VA reserves the right to request the manufacturer to arrange for a VA representative to see typical active systems in operation, when there has been no prior experience with the manufacturer or the type of equipment being submitted.

1.11 SINGULAR NUMBER

Where any device or part of equipment is referred to in these specifications in the singular number (e.g., "the switch"), this reference shall be deemed to apply to as many such devices as are required to complete the installation as shown on the drawings.

1.12 TRAINING

Training shall be provided in accordance with Article, INSTRUCTIONS, of Section 01 00 00, GENERAL REQUIREMENTS.

Training shall be provided for the particular equipment or system as required in each associated specification.

A training schedule shall be developed and submitted by the contractor and approved by the Resident Engineer at least 30 days prior to the planned training.

- - - E N D - - -

SECTION 28 05 13
CONDUCTORS AND CABLES FOR ELECTRONIC SAFETY AND SECURITY

PART 1 - GENERAL

1.1 DESCRIPTION

A. This section specifies the furnishing, installation, and connection of the conductors and cables for electronic safety and security.

1.2 RELATED WORK

Excavation and backfill for cables that are installed in conduit:

Section 31 20 00, EARTH MOVING.

Sealing around penetrations to maintain the integrity of time rated construction: Section 07 84 00, FIRESTOPPING.

General electrical requirements that are common to more than one section in Division 28: Section 28 05 11, REQUIREMENTS FOR ELECTRONIC SAFETY AND SECURITY INSTALLATIONS.

Conduits for cables and wiring: Section 28 05 33, RACEWAYS AND BOXES FOR ELECTRONIC SAFETY AND SECURITY.

Requirements for personnel safety and to provide a low impedance path for possible ground fault currents: Section 28 05 26, GROUNDING AND BONDING FOR ELECTRONIC SAFETY AND SECURITY.

1.3 SUBMITTALS

A. In accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES, furnish the following:

Manufacturer's Literature and Data: Showing each cable type and rating.

Certificates: Two weeks prior to final inspection, deliver to the COTR four copies of the certification that the material is in accordance with the drawings and specifications and has been properly installed.

1.4 APPLICABLE PUBLICATIONS

Publications listed below (including amendments, addenda, revisions, supplements and errata) form a part of this specification to the extent referenced. Publications are reference in the text by the basic designation only.

American Society of Testing Material (ASTM):

D2301-04Standard Specification for Vinyl Chloride
Plastic Pressure Sensitive Electrical Insulating
Tape

Federal Specifications (Fed. Spec.):

A-A-59544-00 Cable and Wire, Electrical (Power, Fixed
Installation)

National Fire Protection Association (NFPA):

70-05 National Electrical Code (NEC)

Underwriters Laboratories, Inc. (UL):

44-02 Thermoset-Insulated Wires and Cables

83-03 Thermoplastic-Insulated Wires and Cables

467-01 Electrical Grounding and Bonding Equipment

486A-01 Wire Connectors and Soldering Lugs for Use with
Copper Conductors

486C-02 Splicing Wire Connectors

486D-02 Insulated Wire Connector Systems for Underground
Use or in Damp or Wet Locations

486E-00 Equipment Wiring Terminals for Use with Aluminum
and/or Copper Conductors

493-01 Thermoplastic-Insulated Underground Feeder and
Branch Circuit Cable

514B-02 Fittings for Cable and Conduit

1479-03 Fire Tests of Through-Penetration Fire Stops

PART 2 - PRODUCTS

2.1 CONTROL WIRING

Unless otherwise specified in other sections of these specifications, control wiring shall be as specified for power and lighting wiring, except the minimum size shall be not less than No. 14 AWG.

Control wiring shall be large enough so that the voltage drop under inrush conditions does not adversely affect operation of the controls.

2.2 COMMUNICATION AND SIGNAL WIRING

Shall conform to the recommendations of the manufacturers of the communication and signal systems; however, not less than what is shown. Wiring shown is for typical systems. Provide wiring as required for the systems being furnished.

Multi-conductor cables shall have the conductors color coded.

2.3 WIRE LUBRICATING COMPOUND

Suitable for the wire insulation and conduit it is used with, and shall not harden or become adhesive.

Shall not be used on wire for isolated type electrical power systems.

2.4 FIREPROOFING TAPE

The tape shall consist of a flexible, conformable fabric of organic composition coated one side with flame-retardant elastomer.

The tape shall be self-extinguishing and shall not support combustion. It shall be arc-proof and fireproof.

The tape shall not deteriorate when subjected to water, gases, salt water, sewage, or fungus and be resistant to sunlight and ultraviolet light.

The finished application shall withstand a 200-ampere arc for not less than 30 seconds.

Securing tape: Glass cloth electrical tape not less than 0.18 mm (7 mils) thick, and 19 mm (3/4 inch) wide.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

Splice cables and wires only in outlet boxes, junction boxes, or pull boxes.

Seal cable and wire entering a building from underground, between the wire and conduit where the cable exits the conduit, with a non-hardening approved compound.

Wire Pulling:

Provide installation equipment that will prevent the cutting or abrasion of insulation during pulling of cables.

Use ropes made of nonmetallic material for pulling feeders.

Attach pulling lines for feeders by means of either woven basket grips or pulling eyes attached directly to the conductors, as approved by the Resident Engineer.

Pull in multiple cables together in a single conduit.

3.2 INSTALLATION IN MANHOLES

A. Install and support cables in manholes on the galvanized steel racks. Train the cables around the manhole walls, but do not bend to a radius less than six times the overall cable diameter.

3.3 SPLICE INSTALLATION

Splices and terminations shall be mechanically and electrically secure.

Where the Government determines that unsatisfactory splices or terminations have been installed, remove the devices and install approved devices at no additional cost to the Government.

3.4 CONTROL, COMMUNICATION AND SIGNAL WIRING INSTALLATION

Unless otherwise specified in other sections, install wiring and connect to equipment/devices to perform the required functions as shown and specified.

Except where otherwise required, install a separate power supply circuit for each system so that malfunctions in any system will not affect other systems.

Where separate power supply circuits are not shown, connect the systems to the nearest panelboards of suitable voltages, which are intended to supply such systems and have suitable spare circuit breakers or space for installation.

Install a red warning indicator on the handle of the branch circuit breaker for the power supply circuit for each system to prevent accidental de-energizing of the systems.

System voltages shall be 120 volts or lower where shown on the drawings or as required by the NEC.

3.5 CONTROL, COMMUNICATION AND SIGNAL SYSTEM IDENTIFICATION

Install a permanent wire marker on each wire at each termination.

Identifying numbers and letters on the wire markers shall correspond to those on the wiring diagrams used for installing the systems.

Wire markers shall retain their markings after cleaning.

In each manhole and handhole, install embossed brass tags to identify the system served and function.

3.5 EXISTING WIRING

Unless specifically indicated on the plans, existing wiring shall not be reused for the new installation. Only wiring that conforms to the specifications and applicable codes may be reused. If existing wiring does not meet these requirements, existing wiring may not be reused and new wires shall be installed.

- - - E N D - - -

SECTION 28 05 26
GROUNDING AND BONDING FOR ELECTRONIC SAFETY AND SECURITY

PART 1 - GENERAL

1.1 DESCRIPTION

This section specifies general grounding and bonding requirements of electronic safety and security installations for equipment operations. "Grounding electrode system" refers to all electrodes required by NEC, as well as including made, supplementary, grounding electrodes. The terms "connect" and "bond" are used interchangeably in this specification and have the same meaning.

1.2 RELATED WORK

Section 28 05 11, REQUIREMENTS FOR ELECTRONIC SAFETY AND SECURITY INSTALLATIONS: General electrical requirements and items that are common to more than one section of Division 28.

Section 28 05 13, CONDUCTORS AND CABLES FOR ELECTRONIC SAFETY AND SECURITY: Low Voltage power and lighting wiring.

1.3 SUBMITTALS

A. Submit in accordance with Section 28 05 11, REQUIREMENTS FOR ELECTRONIC SAFETY AND SECURITY INSTALLATIONS.

B. Shop Drawings:

Sufficient information, clearly presented, shall be included to determine compliance with drawings and specifications.

Include the location of system grounding electrode connections and the routing of aboveground and underground grounding electrode conductors.

C. Test Reports: Provide certified test reports of ground resistance.

D. Certifications: Two weeks prior to final inspection, submit four copies of the following to the COTR:

Certification that the materials and installation is in accordance with the drawings and specifications.

Certification, by the Contractor, that the complete installation has been properly installed and tested.

1.4 APPLICABLE PUBLICATIONS

Publications listed below (including amendments, addenda, revisions, supplements, and errata) form a part of this specification to the extent referenced. Publications are referenced in the text by the basic designation only.

A. American Society for Testing and Materials (ASTM):

- B1-2001 Standard Specification for Hard-Drawn Copper Wire
- B8-2004 Standard Specification for Concentric-Lay-Stranded Copper Conductors, Hard, Medium-Hard, or Soft
- Institute of Electrical and Electronics Engineers, Inc. (IEEE):
- 81-1983 IEEE Guide for Measuring Earth Resistivity, Ground Impedance, and Earth Surface Potentials of a Ground System
- National Fire Protection Association (NFPA):
- 70-2005 National Electrical Code (NEC)
- Underwriters Laboratories, Inc. (UL):
- 44-2005 Thermoset-Insulated Wires and Cables
- 83-2003 Thermoplastic-Insulated Wires and Cables
- 467-2004 Grounding and Bonding Equipment
- 486A-486B-2003 Wire Connectors

PART 2 - PRODUCTS

2.1 GROUNDING AND BONDING CONDUCTORS

Equipment grounding conductors shall be UL 83 insulated stranded copper, except that sizes 6 mm² (10 AWG) and smaller shall be solid copper. Insulation color shall be continuous green for all equipment grounding conductors, except that wire sizes 25 mm² (4 AWG) and larger shall be permitted to be identified per NEC.

Bonding conductors shall be ASTM B8 bare stranded copper, except that sizes 6 mm² (10 AWG) and smaller shall be ASTM B1 solid bare copper wire.

Isolated Power System: Type XHHW-2 insulation with a dielectric constant of 3.5 or less.

2.2 GROUND RODS

Copper clad steel, 19 mm (3/4-inch) diameter by 3000 mm (10 feet) long, conforming to UL 467.

Quantity of rods shall be as required to obtain the specified ground resistance.

2.3 SPLICES AND TERMINATION COMPONENTS

Components shall meet or exceed UL 467 and be clearly marked with the manufacturer, catalog number, and permitted conductor size(s).

2.4 GROUND CONNECTIONS

A. Below Grade: Exothermic-welded type connectors.

B. Above Grade:

Bonding Jumpers: compression type connectors, using zinc-plated fasteners and external tooth lockwashers.

Ground Busbars: Two-hole compression type lugs using tin-plated copper or copper alloy bolts and nuts.

Rack and Cabinet Ground Bars: one-hole compression-type lugs using zinc-plated or copper alloy fasteners.

2.5 EQUIPMENT RACK AND CABINET GROUND BARS

Provide solid copper ground bars designed for mounting on the framework of open or cabinet-enclosed equipment racks with minimum dimensions of 4 mm thick by 19 mm wide (3/8 inch x 3/4 inch).

2.6 GROUND TERMINAL BLOCKS

At any equipment mounting location (e.g. backboards and hinged cover enclosures) where rack-type ground bars cannot be mounted, provide screw lug-type terminal blocks.

PART 3 - EXECUTION**3.1 GENERAL**

Ground in accordance with the NEC, as shown on drawings, and as hereinafter specified.

Equipment Grounding: Metallic structures (including ductwork and building steel), enclosures, raceways, junction boxes, outlet boxes, cabinets, machine frames, and other conductive items in close proximity with electrical circuits shall be bonded and grounded with green insulated conductor per 2.1.A.

3.2 INACCESSIBLE GROUNDING CONNECTIONS

Make grounding connections, which are buried or otherwise normally inaccessible (except connections for which periodic testing access is required) by exothermic weld.

3.3 CORROSION INHIBITORS

When making ground and ground bonding connections, apply a corrosion inhibitor to all contact surfaces. Use corrosion inhibitor appropriate for protecting a connection between the metals used.

3.4 CONDUCTIVE PIPING

A. Bond all conductive piping systems, interior and exterior, to the building to the grounding electrode system. Bonding connections shall be made as close as practical to the equipment ground bus.

3.5 WIREWAY GROUNDING

A. Ground and Bond Metallic Wireway Systems as follows:

Bond the metallic structures of wireway to provide 100 percent electrical continuity throughout the wireway system by connecting a 16 mm² (6 AWG) bonding jumper at all intermediate metallic enclosures and across all section junctions.

Install insulated 16 mm² (6 AWG) bonding jumpers between the wireway system bonded as required in paragraph 1 above, and the closest building ground at each end and approximately every 16 meters (50 feet).

Use insulated 16 mm² (6 AWG) bonding jumpers to ground or bond metallic wireway at each end at all intermediate metallic enclosures and across all section junctions.

Use insulated 16 mm² (6 AWG) bonding jumpers to ground cable tray to column-mounted building ground plates (pads) at each end and approximately every 15 meters.

3.6 GROUND RESISTANCE

Grounding system resistance to ground shall not exceed 5 ohms. Make necessary modifications or additions to the grounding electrode system for compliance without additional cost to the Government. Final tests shall assure that this requirement is met.

Resistance of the grounding electrode system shall be measured using a four-terminal fall-of-potential method as defined in IEEE 81. Ground resistance measurements shall be made before the electrical distribution system is energized and shall be made in normally dry conditions not less than 48 hours after the last rainfall. Resistance measurements of separate grounding electrode systems shall be made before the systems are bonded together below grade. The combined resistance of separate systems may be used to meet the required resistance, but the specified number of electrodes must still be provided.

Services at power company interface points shall comply with the power company ground resistance requirements.

Below-grade connections shall be visually inspected by the Resident Engineer prior to backfilling. The Contractor shall notify the Resident Engineer 24 hours before the connections are ready for inspection.

3.7 GROUND ROD INSTALLATION

A. Drive each rod vertically in the earth, not less than 3000 mm (10 feet) in depth.

Where permanently concealed ground connections are required, make the connections by the exothermic process to form solid metal joints. Make accessible ground connections with mechanical pressure type ground connectors.

Where rock prevents the driving of vertical ground rods, install angled ground rods or grounding electrodes in horizontal trenches to achieve the specified resistance. **3.8 GROUNDING FOR RF/EMI CONTROL**

Install bonding jumpers to bond all conduit, cable trays, sleeves and equipment for low voltage signaling and data communications circuits. Bonding jumpers shall consist of 100 mm (4 inches) wide copper strip or two 6 mm² (10 AWG) copper conductors spaced minimum 100 mm (4 inches) apart. Use 16 mm² (6 AWG) copper where exposed and subject to damage. Comply with the following when shielded cable is used for data circuits.

Shields shall be continuous throughout each circuit.

Connect shield drain wires together at each circuit connection point and insulate from ground. Do not ground the shield.

Do not connect shields from different circuits together.

Shield shall be connected at one end only. Connect shield to signal reference at the origin of the circuit. Consult with equipment manufacturer to determine signal reference.

- - - E N D - - -

THIS PAGE INTENTIONALLY LEFT BLANK

SECTION 28 05 33
RACEWAYS AND BOXES FOR ELECTRONIC SAFETY AND SECURITY

PART 1 - GENERAL

1.1 DESCRIPTION

This section specifies the furnishing, installation, and connection of conduit, fittings, and boxes to form complete, coordinated, raceway systems. Raceways are required for all electronic safety and security cabling unless shown or specified otherwise.

Definitions: The term conduit, as used in this specification, shall mean any or all of the raceway types specified.

1.2 RELATED WORK

Bedding of conduits: Section 31 20 00, EARTH MOVING.

Mounting board for communication closets: Section 06 10 00, ROUGH CARPENTRY.

Sealing around penetrations to maintain the integrity of fire rated construction: Section 07 84 00, FIRESTOPPING.

Sealing around conduit penetrations through the building envelope to prevent moisture migration into the building: Section 07 92 00, JOINT SEALANTS.

Identification and painting of conduit and other devices: Section 09 91 00, PAINTING.

General electrical requirements and items that is common to more than one section of Division 28: Section 28 05 11, REQUIREMENTS FOR ELECTRONIC SAFETY AND SECURITY INSTALLATIONS.

Requirements for personnel safety and to provide a low impedance path for possible ground fault currents: Section 28 05 26, GROUNDING AND BONDING FOR ELECTRONIC SAFETY AND SECURITY.

1.3 SUBMITTALS

In accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES, furnish the following:

A. Shop Drawings:

Size and location of main feeders;

Size and location of panels and pull boxes

Layout of required conduit penetrations through structural elements.

The specific item proposed and its area of application shall be identified on the catalog cuts.

B. Certification: Prior to final inspection, deliver to the COTR four copies of the certification that the material is in accordance with the drawings and specifications and has been properly installed.

1.4 APPLICABLE PUBLICATIONS

Publications listed below (including amendments, addenda, revisions, supplements and errata) form a part of this specification to the extent referenced. Publications are referenced in the text by the basic designation only.

National Fire Protection Association (NFPA):

70-05 National Electrical Code (NEC)

Underwriters Laboratories, Inc. (UL):

1-03 Flexible Metal Conduit

5-01 Surface Metal Raceway and Fittings

6-03 Rigid Metal Conduit

50-03 Enclosures for Electrical Equipment

360-03 Liquid-Tight Flexible Steel Conduit

467-01 Grounding and Bonding Equipment

514A-01 Metallic Outlet Boxes

514B-02 Fittings for Cable and Conduit

514C-05 Nonmetallic Outlet Boxes, Flush-Device Boxes and
Covers

651-02 Schedule 40 and 80 Rigid PVC Conduit

651A-03 Type EB and A Rigid PVC Conduit and HDPE Conduit

797-03 Electrical Metallic Tubing

1242-00 Intermediate Metal Conduit

National Electrical Manufacturers Association (NEMA):

TC-3-04 PVC Fittings for Use with Rigid PVC Conduit and
Tubing

FB1-03 Fittings, Cast Metal Boxes and Conduit Bodies
for Conduit, Electrical Metallic Tubing and
Cable

PART 2 - PRODUCTS

2.1 MATERIAL

Conduit Size: In accordance with the NEC, but not less than 19 mm (3/4 inch) unless otherwise shown. Where permitted by the NEC, 19 mm (3/4 inch) flexible conduit may be used for tap connections to recessed lighting fixtures.

Conduit:

Rigid galvanized steel: Shall Conform to UL 6, ANSI C80.1.

Rigid aluminum: Shall not be used.

Rigid intermediate steel conduit (IMC): Shall Conform to UL 1242,
ANSI C80.6.

Electrical metallic tubing (EMT): Shall Conform to UL 797, ANSI C80.3. Maximum size not to exceed 105 mm (4 inch) and shall be permitted only with cable rated 600 volts or less.

Flexible galvanized steel conduit: Shall Conform to UL 1.

Liquid-tight flexible metal conduit: Shall Conform to UL 360.

Direct burial plastic conduit: Shall conform to UL 651 and UL 651A, heavy wall PVC or high density polyethylene (PE).

Surface metal raceway: Shall Conform to UL 5.

C. Conduit Fittings:

1. Rigid steel and IMC conduit fittings:

- a. Fittings shall meet the requirements of UL 514B and ANSI/NEMA FB1.

Standard threaded couplings, locknuts, bushings, and elbows: Only steel or malleable iron materials are acceptable. Integral retractable type IMC couplings are also acceptable.

Locknuts: Bonding type with sharp edges for digging into the metal wall of an enclosure.

Bushings: Metallic insulating type, consisting of an insulating insert molded or locked into the metallic body of the fitting. Bushings made entirely of metal or nonmetallic material are not permitted.

Sealing fittings: Threaded cast iron type. Use continuous drain type sealing fittings to prevent passage of water vapor. In concealed work, install fittings in flush steel boxes with blank cover plates having the same finishes as that of other electrical plates in the room.

2. Rigid aluminum conduit fittings: Shall not be used.a.

3. Electrical metallic tubing fittings:

Fittings shall meet the requirements of UL 514B and ANSI/NEMA FB1.

Only steel or malleable iron materials are acceptable.

Couplings and connectors: Concrete tight and rain tight, with connectors having insulated throats. Use gland and ring compression type couplings and connectors for conduit sizes 50 mm (2 inches) and smaller. Use set screw type couplings with four set screws each for conduit sizes over 50 mm (2 inches). Use set screws of case-hardened steel with hex head and cup point to firmly seat in wall of conduit for positive grounding.

Indent type connectors or couplings are prohibited.

- e. Die-cast or pressure-cast zinc-alloy fittings or fittings made of "pot metal" are prohibited.
- 4. Flexible steel conduit fittings:
Conform to UL 514B. Only steel or malleable iron materials are acceptable.
Clamp type, with insulated throat.
- 5. Liquid-tight flexible metal conduit fittings:
Fittings shall meet the requirements of UL 514B and ANSI! NEMA FB1.
Only steel or malleable iron materials are acceptable.
Fittings must incorporate a threaded grounding cone, a steel or plastic compression ring, and a gland for tightening.
Connectors shall have insulated throats.
- 6. Direct burial plastic conduit fittings:
Fittings shall meet the requirements of UL 514C and NEMA TC3.
As recommended by the conduit manufacturer.
- 7. Surface metal raceway fittings: As recommended by the raceway manufacturer.
- 8. Expansion and deflection couplings:
 - a. Conform to UL 467 and UL 514B.
 - b. Accommodate, 19 mm (0.75 inch) deflection, expansion, or contraction in any direction, and allow 30 degree angular deflections.
 - c. Include internal flexible metal braid sized to guarantee conduit ground continuity and fault currents in accordance with UL 467, and the NEC code tables for ground conductors.
 - d. Jacket: Flexible, corrosion-resistant, watertight, moisture and heat resistant molded rubber material with stainless steel jacket clamps.
- D. Conduit Supports:
 - Parts and hardware: Zinc-coat or provide equivalent corrosion protection.
 - Individual Conduit Hangers: Designed for the purpose, having a pre-assembled closure bolt and nut, and provisions for receiving a hanger rod.
 - Multiple conduit (trapeze) hangers: Not less than 38 mm by 38 mm (1-1!2 by 1-1!2 inch), 12 gage steel, cold formed, lipped channels; with not less than 9 mm (3!8 inch) diameter steel hanger rods.
 - Solid Masonry and Concrete Anchors: Self-drilling expansion shields, or machine bolt expansion.

E. Outlet, Junction, and Pull Boxes:

UL-50 and UL-514A.

Cast metal where required by the NEC or shown, and equipped with rustproof boxes.

Sheet metal boxes: Galvanized steel, except where otherwise shown. Flush mounted wall or ceiling boxes shall be installed with raised covers so that front face of raised cover is flush with the wall. Surface mounted wall or ceiling boxes shall be installed with surface style flat or raised covers.

F. Wireways: Equip with hinged covers, except where removable covers are shown.

G. Warning Tape: Standard, 4-Mil polyethylene 76 mm (3 inch) wide tape detectable type, red with black letters, and imprinted with "CAUTION BURIED ELECTRONIC SAFETY AND SECURITY CABLE BELOW".

PART 3 - EXECUTION

3.1 PENETRATIONS

A. Cutting or Holes:

Locate holes in advance where they are proposed in the structural sections such as ribs or beams. Obtain the approval of the COTR prior to drilling through structural sections.

Cut holes through concrete and masonry in new and existing structures with a diamond core drill or concrete saw. Pneumatic hammer, impact electric, hand or manual hammer type drills are not allowed, except where permitted by the COTR as required by limited working space.

B. Fire Stop: Where conduits, wireways, and other electronic safety and security raceways pass through fire partitions, fire walls, smoke partitions, or floors, install a fire stop that provides an effective barrier against the spread of fire, smoke and gases as specified in Section 07 84 00, FIRESTOPPING, with rock wool fiber or silicone foam sealant only. Completely fill and seal clearances between raceways and openings with the fire stop material.

C. Waterproofing: At floor, exterior wall, and roof conduit penetrations, completely seal clearances around the conduit and make watertight as specified in Section 07 92 00, JOINT SEALANTS.

3.2 INSTALLATION, GENERAL

A. Install conduit as follows:

In complete runs before pulling in cables or wires.

Flattened, dented, or deformed conduit is not permitted. Remove and replace the damaged conduits with new undamaged material.

Assure conduit installation does not encroach into the ceiling height head room, walkways, or doorways.

Cut square with a hacksaw, ream, remove burrs, and draw up tight.

Mechanically continuous.

Independently support conduit at 8'0" on center. Do not use other supports i.e., (suspended ceilings, suspended ceiling supporting members, lighting fixtures, conduits, mechanical piping, or mechanical ducts).

Support within 300 mm (1 foot) of changes of direction, and within 300 mm (1 foot) of each enclosure to which connected.

Close ends of empty conduit with plugs or caps at the rough-in stage to prevent entry of debris, until wires are pulled in.

Conduit installations under fume and vent hoods are prohibited.

Secure conduits to cabinets, junction boxes, pull boxes and outlet boxes with bonding type locknuts. For rigid and IMC conduit installations, provide a locknut on the inside of the enclosure, made up wrench tight. Do not make conduit connections to junction box covers.

Flashing of penetrations of the roof membrane is specified in Section 07 60 00, FLASHING AND SHEET METAL.

Do not use aluminum conduits in wet locations.

Unless otherwise indicated on the drawings or specified herein, all conduits shall be installed concealed within finished walls, floors and ceilings.

B. Conduit Bends:

Make bends with standard conduit bending machines.

Conduit hickey may be used for slight offsets, and for straightening stubbed out conduits.

Bending of conduits with a pipe tee or vise is prohibited.

C. Layout and Homeruns:

Install conduit with wiring, including homeruns, as shown.

Deviations: Make only where necessary to avoid interferences and only after drawings showing the proposed deviations have been submitted approved by the COTR.

D. Fire Alarm:

1. Fire alarm conduit shall be painted red (a red "top-coated" conduit from the conduit manufacturer may be used in lieu of painted conduit) in accordance with the requirements of Section 28 31 00, Fire Detection and Alarm.

3.3 CONCEALED WORK INSTALLATION

A. In Concrete:

1. Conduit: Rigid steel, IMC or EMT. Do not install EMT in concrete slabs that are in contact with soil, gravel or vapor barriers.
2. Align and run conduit in direct lines.
3. Install conduit through concrete beams only when the following occurs:

Where shown on the structural drawings.

As approved by the COTR prior to construction, and after submittal of drawing showing location, size, and position of each penetration.

4. Installation of conduit in concrete that is less than 75 mm (3 inches) thick is prohibited.
Conduit outside diameter larger than 1/3 of the slab thickness is prohibited.
Space between conduits in slabs: Approximately six conduit diameters apart, except one conduit diameter at conduit crossings.
Install conduits approximately in the center of the slab so that there will be a minimum of 19 mm (3/4 inch) of concrete around the conduits.
5. Make couplings and connections watertight. Use thread compounds that are UL approved conductive type to insure low resistance ground continuity through the conduits. Tightening set screws with pliers is prohibited.

B. Furred or Suspended Ceilings and in Walls:

1. Conduit for conductors above 600 volts:
Rigid steel or rigid aluminum.
Aluminum conduit mixed indiscriminately with other types in the same system is prohibited.
2. Conduit for conductors 600 volts and below:
 - a. Rigid steel, IMC, rigid aluminum, or EMT. Different type conduits mixed indiscriminately in the same system is prohibited.
3. Align and run conduit parallel or perpendicular to the building lines.
4. Connect recessed lighting fixtures to conduit runs with maximum 1800 mm (six feet) of flexible metal conduit extending from a junction box to the fixture.
5. Tightening set screws with pliers is prohibited.

3.4 EXPOSED WORK INSTALLATION

- A. Unless otherwise indicated on the drawings, exposed conduit is only permitted in mechanical and electrical rooms.
- B. Conduit for conductors above 600 volts:
Rigid steel or rigid aluminum.
Aluminum conduit mixed indiscriminately with other types in the same system is prohibited.
- C. Conduit for Conductors 600 volts and below:
 - 1. Rigid steel, IMC, rigid aluminum, or EMT. Different type of conduits mixed indiscriminately in the system is prohibited.
- D. Align and run conduit parallel or perpendicular to the building lines.
- E. Install horizontal runs close to the ceiling or beams and secure with conduit straps.
- F. Support horizontal or vertical runs at not over 2400 mm (eight foot) intervals.
- G. Surface metal raceways: Use only where shown.
- H. Painting:
Paint exposed conduit as specified in Section 09 91 00, PAINTING.
Paint all conduits containing cables rated over 600 volts safety orange. Refer to Section 09 91 00, PAINTING for preparation, paint type, and exact color. In addition, paint legends, using 50 mm (two inch) high black numerals and letters, showing the cable voltage rating. Provide legends where conduits pass through walls and floors and at maximum 6000 mm (20 foot) intervals in between.

3.5 EXPANSION JOINTS

- Conduits 75 mm (3 inches) and larger, that are secured to the building structure on opposite sides of a building expansion joint, require expansion and deflection couplings. Install the couplings in accordance with the manufacturer's recommendations.
- Provide conduits smaller than 75 mm (3 inches) with junction boxes on both sides of the expansion joint. Connect conduits to junction boxes with sufficient slack of flexible conduit to produce 125 mm (5 inch) vertical drop midway between the ends. Flexible conduit shall have a copper green ground bonding jumper installed. In lieu of this flexible conduit, expansion and deflection couplings as specified above for 375 mm (15 inches) and larger conduits are acceptable.
- Install expansion and deflection couplings where shown.

3.6 CONDUIT SUPPORTS, INSTALLATION

- A. Safe working load shall not exceed 1/4 of proof test load of fastening devices.
- B. Use pipe straps or individual conduit hangers for supporting individual conduits. Maximum distance between supports is 2.5 m (8 foot) on center.
- C. Support multiple conduit runs with trapeze hangers. Use trapeze hangers that are designed to support a load equal to or greater than the sum of the weights of the conduits, wires, hanger itself, and 90 kg (200 pounds). Attach each conduit with U-bolts or other approved fasteners.
- D. Support conduit independently of junction boxes, pull boxes, fixtures, suspended ceiling T-bars, angle supports, and similar items.
- E. Fasteners and Supports in Solid Masonry and Concrete:
 - New Construction: Use steel or malleable iron concrete inserts set in place prior to placing the concrete.
 - Existing Construction:
 - Steel expansion anchors not less than 6 mm (1/4 inch) bolt size and not less than 28 mm (1-1/8 inch) embedment.
 - Power set fasteners not less than 6 mm (1/4 inch) diameter with depth of penetration not less than 75 mm (3 inches).
 - Use vibration and shock resistant anchors and fasteners for attaching to concrete ceilings.
- F. Hollow Masonry: Toggle bolts are permitted.
- G. Bolts supported only by plaster or gypsum wallboard are not acceptable.
- H. Metal Structures: Use machine screw fasteners or other devices specifically designed and approved for the application.
- I. Attachment by wood plugs, rawl plug, plastic, lead or soft metal anchors, or wood blocking and bolts supported only by plaster is prohibited.
- J. Chain, wire, or perforated strap shall not be used to support or fasten conduit.
- K. Spring steel type supports or fasteners are prohibited for all uses except: Horizontal and vertical supports/fasteners within walls.
- L. Vertical Supports: Vertical conduit runs shall have riser clamps and supports in accordance with the NEC and as shown. Provide supports for cable and wire with fittings that include internal wedges and retaining collars.

3.7 BOX INSTALLATION

- A. Boxes for Concealed Conduits:
 - 1. Flush mounted.

2. Provide raised covers for boxes to suit the wall or ceiling, construction and finish.

In addition to boxes shown, install additional boxes where needed to prevent damage to cables and wires during pulling in operations. Remove only knockouts as required and plug unused openings. Use threaded plugs for cast metal boxes and snap-in metal covers for sheet metal boxes.

Outlet boxes in the same wall mounted back-to-back are prohibited. A minimum 600 mm (24 inch), center-to-center lateral spacing shall be maintained between boxes.)

Minimum size of outlet boxes for ground fault interrupter (GFI) receptacles is 100 mm (4 inches) square by 55 mm (2-1/8 inches) deep, with device covers for the wall material and thickness involved.

Label all covers of electrical boxes with the panel name and circuits contained in the box. For example, door 101 card reader, door 101 door contact.

On all Branch Circuit junction box covers, identify the circuits with black marker.

For boxes installed in metal stud construction, use rigid support metal bar hangers or metal bar fasteners attached to two studs. Screwing boxes directly to joists or studs is not acceptable.

3.12 ELECTRONIC SAFETY AND SECURITY CONDUIT

Install the electronic safety and security raceway system as shown on drawings.

Minimum conduit size of 19 mm (3/4 inch), but not less than the size shown on the drawings.

All conduit ends shall be equipped with insulated bushings.

All 100 mm (four inch) conduits within buildings shall include pull boxes after every two 90 degree bends. Size boxes per the NEC.

Vertical conduits/sleeves through closets floors shall terminate not less than 75 mm (3 inches) below the floor and not less than 75 mm (3 inches) below the ceiling of the floor below.

Terminate conduit runs to/from a backboard in a closet or interstitial space at the top or bottom of the backboard. Conduits shall enter communication closets next to the wall and be flush with the backboard.

Where drilling is necessary for vertical conduits, locate holes so as not to affect structural sections such as ribs or beams.

All empty conduits located in communications closets or on backboards shall be sealed with a standard non-hardening duct seal compound to

prevent the entrance of moisture and gases and to meet fire resistance requirements.

- I. Conduit runs shall contain no more than four quarter turns (90 degree bends) between pull boxes/backboards. Minimum radius of communication conduit bends shall be as follows (special long radius):

Sizes of Conduit Trade Size	Radius of Conduit Bends mm, Inches
3/4	150 (6)
1	230 (9)
1-1/4	350 (14)
1-1/2	430 (17)
2	525 (21)
2-1/2	635 (25)
3	775 (31)
3-1/2	900 (36)
4	1125 (45)

Furnish and install 19 mm (3/4 inch) thick fire retardant plywood specified in on the wall of communication closets where shown on drawings . Mount the plywood with the bottom edge 300 mm (one foot) above the finished floor.

Furnish and pull wire in all empty conduits. (Sleeves through floor are exceptions).

- - - E N D - - -

THIS PAGE INTENTIONALLY LEFT BLANK

SECTION 28 08 00

COMMISSIONING OF ELECTRONIC SAFETY AND SECURITY SYSTEMS

PART 1 - GENERAL

1.1 DESCRIPTION

The requirements of this Section apply to all sections of Division 28. This project will have selected building systems commissioned. The complete list of equipment and systems to be commissioned are specified in Section 01 91 00 GENERAL COMMISSIONING REQUIREMENTS. The commissioning process, which the Contractor is responsible to execute, is defined in Section 01 91 00 GENERAL COMMISSIONING REQUIREMENTS. A Commissioning Agent (CxA) appointed by the VA will manage the commissioning process.

1.2 RELATED WORK

Section 01 00 00 GENERAL REQUIREMENTS.
Section 01 91 00 GENERAL COMMISSIONING REQUIREMENTS.
Section 01 33 23 SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

1.3 SUMMARY

This Section includes requirements for commissioning the electronic safety and security systems, subsystems and equipment. This Section supplements the general requirements specified in Section 01 91 00 GENERAL COMMISSIONING REQUIREMENTS.

The commissioning activities have been developed to support the VA requirements to meet guidelines for Federal Leadership in Environmental, Energy, and Economic Performance.

The commissioning activities have been developed to support the United States Green Building Council (USGBC) LEEDTM rating program and to support delivery of project performance in accordance with the Contract Documents developed with the approval of the VA.

Commissioning activities and documentation for the LEEDTM section on "Energy and Atmosphere" prerequisite of "Fundamental Building Systems Commissioning".

Commissioning activities and documentation for the LEEDTM section on "Energy and Atmosphere" requirements for the "Enhanced Building System Commissioning" credit.

Activities and documentation for the LEEDTM section on "Measurement and Verification" requirements for the Measurement and Verification credit.

D. Refer to Section 01 91 00 GENERAL COMMISSIONING REQUIREMENTS for more specifics regarding processes and procedures as well as roles and responsibilities for all Commissioning Team members.

1.4 DEFINITIONS

A. Refer to Section 01 91 00 GENERAL COMMISSIONING REQUIREMENTS for definitions.

1.5 COMMISSIONED SYSTEMS

Commissioning of a system or systems specified in this Division is part of the construction process. Documentation and testing of these systems, as well as training of the VA's Operation and Maintenance personnel, is required in cooperation with the VA and the Commissioning Agent.

The following Electronic Safety and Security systems will be commissioned:

Fire Detection and Alarm (Master panel and software, addressable units - i.e. pull stations, flow detectors, heat detectors, etc., controls and alarm functions, horns/bells/door releases and other output devices, and fire command center functions - stairwell communications, stairwell pressurization fan start, mechanical systems shutdowns).

Access Control.

Video Surveillance.

1.6 SUBMITTALS

The commissioning process requires review of selected Submittals. The Commissioning Agent will provide a list of submittals that will be reviewed by the Commissioning Agent. This list will be reviewed and approved by the Resident Engineer prior to forwarding to the Contractor. Refer to Section 01 33 23 SHOP DRAWINGS, PRODUCT DATA, and SAMPLES for further details.

The commissioning process requires Submittal review simultaneously with engineering review. Specific submittal requirements related to the commissioning process are specified in Section 01 91 00 GENERAL COMMISSIONING REQUIREMENTS.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.1 PRE-FUNCTIONAL CHECKLISTS

- A. The Contractor shall complete Pre-Functional Checklists to verify systems, subsystems, and equipment installation is complete and systems are ready for Systems Functional Performance Testing. The Commissioning Agent will prepare Pre-Functional Checklists to be used to document equipment installation. The Contractor shall complete the checklists. Completed checklists shall be submitted to the VA and to the Commissioning Agent for review. The Commissioning Agent may spot check a sample of completed checklists. If the Commissioning Agent determines that the information provided on the checklist is not accurate, the Commissioning Agent will return the marked-up checklist to the Contractor for correction and resubmission. If the Commissioning Agent determines that a significant number of completed checklists for similar equipment are not accurate, the Commissioning Agent will select a broader sample of checklists for review. If the Commissioning Agent determines that a significant number of the broader sample of checklists is also inaccurate, all the checklists for the type of equipment will be returned to the Contractor for correction and resubmission. Refer to SECTION 01 91 00 GENERAL COMMISSIONING REQUIREMENTS for submittal requirements for Pre-Functional Checklists, Equipment Startup Reports, and other commissioning documents.

3.2 CONTRACTORS TESTS

- A. Contractor tests as required by other sections of Division 28 shall be scheduled and documented in accordance with Section 01 00 00 GENERAL REQUIREMENTS. The Commissioning Agent will witness selected Contractor tests. Contractor tests shall be completed prior to scheduling Systems Functional Performance Testing.

3.3 SYSTEMS FUNCTIONAL PERFORMANCE TESTING:

- A. The Commissioning Process includes Systems Functional Performance Testing that is intended to test systems functional performance under steady state conditions, to test system reaction to changes in operating conditions, and system performance under emergency conditions. The Commissioning Agent will prepare detailed Systems Functional Performance Test procedures for review and approval by the Resident Engineer. The Contractor shall review and comment on the tests prior to approval. The Contractor shall provide the required labor, materials, and test equipment identified in the test procedure

to perform the tests. The Commissioning Agent will witness and document the testing. The Contractor shall sign the test reports to verify tests were performed. See Section 01 91 00 GENERAL COMMISSIONING REQUIREMENTS, for additional details.

3.4 TRAINING OF VA PERSONNEL

- A. Training of the VA's operation and maintenance personnel is required in cooperation with the Resident Engineer and Commissioning Agent. Provide competent, factory authorized personnel to provide instruction to operation and maintenance personnel concerning the location, operation, and troubleshooting of the installed systems. The instruction shall be scheduled in coordination with the Resident Engineer after submission and approval of formal training plans. Refer to Section 01 91 00 GENERAL COMMISSIONING REQUIREMENTS and Division 28 Sections for additional Contractor training requirements.

--- END ---

SECTION 28 13 16
ACCESS CONTROL SYSTEM AND DATABASE MANAGEMENT

PART 1 - GENERAL

1.1 DESCRIPTION

Provide and install extension of existing Access Control System and Database Management as specified in this section.

1.2 RELATED WORK

For firestopping application and use, Section 07 84 00, FIRESTOPPING.

For all signage and labeling applications and use, Section 10 14 00, SIGNAGE.

For power connections and cables, Section 26 05 21, LOW VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES (600 VOLTS AND BELOW).

For grounding of equipment, Section 26 05 26, GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS.

For infrastructure, Section 26 05 33, RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS.

For infrastructure, Section 26 05 36, CABLE TRAYS FOR ELECTRICAL SYSTEMS.

For integration, Section 28 26 00, ELECTRONIC PERSONAL PROTECTION SYSTEM (EPPS).

For alarm systems, Section 28 16 11, INTRUSION DETECTION SYSTEM (IDS).

For security cameras, Section 28 23 00, VIDEO SURVEILLANCE.

For emergency and interior communications, Section 28 26 00, ELECTRONIC PERSONAL PROTECTION SYSTEM (EPPS).

For Warranty of Construction see GENERAL CONDITIONS.

For General Requirements, Section 01 00 00, GENERAL REQUIREMENTS.

1.3 QUALITY ASSURANCE

The Contractor shall be responsible for providing, installing, and the operation of the Access Control System and Database Management as shown. The Contractor shall also provide certification as required.

The security system shall be installed and tested to ensure all components are fully compatible as a system and can be integrated with all associated security subsystems, whether the security system is stand-alone or a part of a Information Technology (IT) computer network.

C. The Contractor or security sub-contractor shall be a licensed security Contractor as required within the state or jurisdiction of where the installation work is being conducted.

1.4 SUBMITTALS

Submit below items in conjunction with Master Specification Sections 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES, and Section 02 41 00, DEMOLITION.

Provide certificates of compliance with Section 1.3, Quality Assurance.

Provide a pre-installation and as-built design package in both electronic format and on paper, minimum size 48 x 48 inches (1220 x 1220 millimeters); drawing submittals shall be per the established project schedule.

Pre-installation design and as-built packages shall include, but not be limited to:

1. Index Sheet that shall:

Define each page of the design package to include facility name, building name, floor, and sheet number.

Provide a list of all security abbreviations and symbols.

Reference all general notes that are utilized within the design package.

Specification and scope of work pages for all security systems that are applicable to the design package that will:

Outline all general and job specific work required within the design package.

Provide a device identification table outlining device Identification (ID) and use for all security systems equipment utilized in the design package.

2. Drawing sheets that will be plotted on the individual floor plans or site plans shall:

Include a title block as defined above.

Define the drawings scale in both standard and metric measurements.

Provide device identification and location.

Address all signal and power conduit runs and sizes that are associated with the design of the electronic security system and other security elements (e.g., barriers, etc.).

Identify all pull box and conduit locations, sizes, and fill capacities.

Address all general and drawing specific notes for a particular drawing sheet.

3. A riser drawing for each applicable security subsystem shall:

Indicate the sequence of operation.

Relationship of integrated components on one diagram.

Include the number, size, identification, and maximum lengths of interconnecting wires.

Wire/cable types shall be defined by a wire and cable schedule. The schedule shall utilize a lettering system that will correspond to the wire/cable it represents (example: A = 18 AWG/1 Pair Twisted, Unshielded). This schedule shall also provide the manufacturer's name and part number for the wire/cable being installed.

4. A system drawing for each applicable security system shall:

Identify how all equipment within the system, from main panel to device, shall be laid out and connected.

Provide full detail of all system components wiring from point-to-point.

Identify wire types utilized for connection, interconnection with associate security subsystems.

Show device locations that correspond to the floor plans.

All general and drawing specific notes shall be included with the system drawings.

5. A schedule for all of the applicable security subsystems shall be included. All schedules shall provide the following information:

Device ID.

Device Location (e.g. site, building, floor, room number, location, and description).

Mounting type (e.g. flush, wall, surface, etc.).

Power supply or circuit breaker and power panel number.

In addition, for the CCTV Systems, provide the camera ID, camera type (e.g. fixed or pan/tilt/zoom (P/T/Z), lens type (e.g. for fixed cameras only) and housing model number.

6. Detail and elevation drawings for all devices that define how they were installed and mounted.

E. Pre-installation design packages shall be reviewed by the Contractor along with a VA representative to ensure all work has been completed. All reviews shall be conducted in accordance with the project schedule. There shall be four (4) stages to the review process:

- 35 percent
- 65 percent
- 90 percent
- 100 percent

F. Provide manufacturer security system product cut-sheets. Submit for approval at least 30 days prior to commencement of formal testing, a Security System Operational Test Plan. Include procedures for operational testing of each component and security subsystem, to include performance of an integrated system test.

G. Submit manufacture's certification of Underwriters Laboratories, Inc. (UL) listing as specified. Provide all maintenance and operating manuals per Section 01 00 00, GENERAL REQUIREMENTS. 1.5

APPLICABLE PUBLICATIONS

The publications listed below (including amendments, addenda, revisions, supplement, and errata) form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.

American National Standards Institute (ANSI)/Electronic Industries Alliance (EIA):

310DRacks, Panels, and Associated Equipment

National Electrical Manufactures Association (NEMA):

250-03Enclosures for Electrical Equipment

National Fire Protection Association (NFPA):

70-05Article 780-National Electrical Code

Underwriters Laboratories, Inc. (UL):

752-05Ballistic Level Protection (Class III)

827-96Central Station Alarm Services

1981-03Central Station Automation System

Uniform Federal Accessibility Standards (UFAS) 1984

Americans with Disabilities Act (ADA) 1975

ADA Standards for Accessible Design 1994

1.6 WARRANTY OF CONSTRUCTION.

Warrant CCTV System work subject to the Article "Warranty of Construction" of FAR clause 52.246-21.

PART 2 - PRODUCTS

2.1 EQUIPMENT AND MATERIALS

All equipment associated within the Access Control System and Database Management shall be UL 827 and UL 1981 compliant and rated for continuous operation. Environmental conditions (i.e. temperature, humidity, wind, and seismic activity) shall be taken under consideration at each facility and site location prior to installation of the equipment.

All equipment shall operate on a 120 or 240 volts alternating current (VAC); 50 Hz or 60 Hz AC power system unless documented otherwise in subsequent sections listed within this specification. All equipment shall have a back-up source of power that will provide a minimum of 96 hours of run time in the event of a loss of primary power to the facility.

The system shall be designed, installed, and programmed in a manner that will allow for easy of operation, programming, servicing, maintenance, testing, and upgrading of the system. All equipment and materials for the system will be compatible to ensure correct operation.

2.2 EQUIPMENT ITEMS

The Access Control System and Database Management shall be set up as a Security System Network (SSN).

A SSN shall provide full interface with all components of the security subsystem as follows:

1. Shall allow for communication between the Access Control System and Database Management and all subordinate work and monitoring stations, enrollment centers for badging and biometric devices as part of the PACS, local annunciation centers, the electronic Security Management System (SMS), and all other VA redundant or backup command center or other workstations locations.

Shall provide automatic continuous communication with all systems that are monitored by the Access Control System and Database Management, and shall automatically annunciate any communication failures or system alarms to the Access Control System and Database Management operator providing identification of the system, nature of the alarm, and location of the alarm.

Controlling devices shall be utilized to interface the Access Control System and Database Management with all field devices. The Access Control System and Database Management and security console will be supported by an uninterrupted power supply (UPS) or dedicated backup generator power circuit.

The existing Access Control System and Database Management houses the following equipment i.e. refer to individual master specifications for each security subsystem's specific requirements:

Security Console Bays and Equipment Racks

Security Network Server and Workstation

CCTV Monitoring, Controlling, and Recording Equipment

PACS Monitoring and Controlling Equipment

IDS Monitoring and Controlling Equipment

Security Access Detection Monitoring Equipment

EPPS Monitoring and Controlling Equipment

Main Panels for all Security Systems

Power Supply Units (PSU) for all field devices

Life safety and power monitoring equipment

All other building systems deemed necessary by the VA to include, but not limited to, heating, ventilation and air conditioning (HVAC), elevator control, portable radio, fire alarm monitoring, and other potential systems.

Security Console Bays are existing EIA 310D compliant.

Remote/Secondary Access Control System and Database Management's:

For facilities that have a remote, secondary back-up control console or workstation shall apply the following requirements: 1.

The secondary stations shall the requirements outlined in Sections 2.2.A-G.

Installation of an intercom station or telephone line shall be installed and provide direct one touch call-up for communications between the primary Access Control System and Database Management and secondary Access Control System and Database Management.

Secondary stations shall not have priority over a primary Access Control System and Database Management.

The primary Access Control System and Database Management shall have the ability to shut off power and a signal to a secondary control station in the event the area has been compromised.

E. Wires and Cables:

Shall meet or exceed the manufactures recommendation for power and signals.

Shall be carried in an enclosed conduit system, utilizing electromagnetic tubing (EMT) to include the equivalent in flexible metal, rigid galvanized steel (RGS) to include the equivalent of liquid tight, polyvinylchloride (PVC) schedule 40 or 80.

All conduits will be sized 19 mm (3/4 inch) or larger and installed per the NEC. All security system signal and power cables that traverse or originate in a high security office space will contained in either EMT or RGS conduit.

All conduit, pull boxes, and junction boxes shall be marked with colored permanent tape or paint that will allow it to be distinguished from all other infrastructure conduit.

Conduit fills shall not exceed 50 percent unless otherwise documented.

A pull string shall be pulled along and provided with signal and power cables to assist in future installations.

At all locations where there is a wall penetration or core drilling is conducted to allow for conduit to be installed, fire stopping materials shall be applied to that area.

High voltage and signal cables shall not share the same conduit and shall be kept separate up to the point of connection. High voltage for the security subsystems shall be any cable or sets of cables carrying 30 VDC/VAC or higher.

9. For all equipment that is carrying digital data between the Access Control System and Database Management or at a remote monitoring station, it shall not be less than 20 AWG and stranded copper wire for each conductor. The cable or each individual conductor within the cable shall have a shield that provides 100% coverage. Cables with a single overall shield shall have a tinned copper shield drain wire.
10. All cables and conductors, except fiber optic cables, that act as a control, communication, or signal lines shall include surge protection. Surge protection shall be furnished at the equipment end and additional triple electrode gas surge protectors rated for the application on each wire line circuit shall be installed within three (3) ft. (one (1) m.) of the building cable entrance. The inputs and outputs shall be tested in both normal and common mode using the following wave forms:
 - A 10 microsecond rise time by 1000 microsecond pulse width waveform with a peak voltage of 1500 volts and peak current of 60 amperes.
 - An 8 microsecond rise time by 20 microsecond pulse width wave form with a peak voltage of 1000 volts and peak current of 500 amperes.
11. The surge suppression device shall not attenuate or reduce the video or sync signal under normal conditions. Fuses and relays shall not be used as a means of surge protection.

2.3 INSTALLATION KIT

A. General:

1. The kit shall be provided that, at a minimum, includes all connectors and terminals, labeling systems, audio spade lugs, barrier strips, punch blocks or wire wrap terminals, heat shrink tubing, cable ties, solder, hangers, clamps, bolts, conduit, cable duct, and/or cable tray, etc., required to accomplish a neat and secure installation. All wires shall terminate in a spade lug and barrier strip, wire wrap terminal or punch block. Unfinished or unlabeled wire connections shall not be allowed. All unused and partially opened installation kit boxes, coaxial, fiber-optic, and twisted pair cable reels, conduit, cable tray, and/or cable duct bundles, wire rolls,

physical installation hardware shall be turned over to the Contracting Officer. The following sections outline the minimum required installation sub-kits to be used:

2. System Grounding:

The grounding kit shall include all cable and installation hardware required. All head end equipment and power supplies shall be connected to earth ground via internal building wiring, according to the NEC.

This includes, but is not limited to:

- Coaxial Cable Shields
- Control Cable Shields
- Data Cable Shields
- Equipment Racks
- Equipment Cabinets
- Conduits
- Cable Duct blocks
- Cable Trays
- Power Panels
- Grounding
- Connector Panels

3. Coaxial Cable: The coaxial cable kit shall include all coaxial connectors, cable tying straps, heat shrink tabbing, hangers, clamps, etc., required to accomplish a neat and secure installation.
4. Wire and Cable: The wire and cable kit shall include all connectors and terminals, audio spade lugs, barrier straps, punch blocks, wire wrap strips, heat shrink tubing, tie wraps, solder, hangers, clamps, labels etc., required to accomplish a neat and orderly installation.
5. Conduit, Cable Duct, and Cable Tray: The kit shall include all conduit, duct, trays, junction boxes, back boxes, cover plates, feed through nipples, hangers, clamps, other hardware required to accomplish a neat and secure conduit, cable duct, and/or cable tray installation in accordance with the NEC and this document.

Equipment Interface: The equipment kit shall include any item or quantity of equipment, cable, mounting hardware and materials needed to interface the systems with the identified subsystem(s) according to the OEM requirements and this document.

Labels: The labeling kit shall include any item or quantity of labels, tools, stencils, and materials needed to label each subsystem according to the OEM requirements, as-installed drawings, and this document.

Documentation: The documentation kit shall include any item or quantity of items, computer discs, as installed drawings, equipment, maintenance, and operation manuals, and OEM materials needed to provide the system documentation as required by this document and explained herein.

PART 3

3.1 INSTALLATION

System installation shall be in accordance with manufacturer and related documents and references, for each type of security subsystem designed, engineered and installed.

All equipment shall be installed per the design package and the manufacturer's installation specifications.

The Access Control System and Database Management will be designed, engineered, installed, and tested to ensure all components are fully compatible as a system and can be integrated with all associated security subsystems, whether the system is a stand alone or a network.

For integration purposes, the Access Control System and Database Management shall operate and control the following associated security subsystems:

The Access Control System and Database Management shall be the central point of monitoring, controlling, programming, and recording all security subsystems utilizing the Electronic Security Management System (SMS).

The SMS shall utilize a central computer station that is capable of being connected to the VA's Local Area Network (LAN) or Internet.

Integration with security subsystems shall be achieved by computer programming and the direct hardwiring of the systems.

Determination of methodology should be addressed and outlined in advance with the Contracting Officer prior to the system(s) is/are being designed and engineered.

For programming purposes, the Contractor shall refer to the manufacturer's requirements for correct system operations.

Ensure computers being utilized for system integration meet or exceed the minimum system requirements outlined on the systems software packages.

The Contractor shall visit the site and verify that site conditions are in agreement with the design package. The Contractor shall report all changes to the site or conditions that will affect performance of the security subsystems. The Contractor shall not take any corrective action without written permission from the Contracting Officer.

System Startup:

1. The Contractor shall not apply power to the Access Control System and Database Management or security console until the following items have been completed:
 - Access Control System and Database Management equipment items and have been set up in accordance with manufacturer's instructions.
 - A visual inspection of the Access Control System and Database Management has been conducted to ensure that defective equipment items have not been installed and that there are no loose connections.
 - System wiring has been tested and verified as correctly connected as indicated.
 - All system grounding and transient protection systems have been verified as installed and connected as indicated.
 - Power to be connected to all systems has been verified as the correct voltage, phasing, and frequency as indicated.
2. Satisfaction of the above requirements shall not relieve the Contractor of responsibility for incorrect installations, defective equipment items, or collateral damage as a result of Contractor work/equipment installation efforts.

I. Supplemental Contractor Quality Control:

1. The following requirements supplement the contractor quality control requirements specified elsewhere in the contract:

The Contractor shall provide the services of technical representatives who are familiar with all components and installation procedures of the installed Access Control System and Database Management and security console; and are approved by the Contracting Officer in advance.

The Contractor representatives will be present on the job site during the preparatory and initial phases of quality control to provide technical assistance.

The Contractor representatives shall also be available on an as needed basis to provide assistance with follow-up phases of quality control.

The Contractor technical representatives shall participate in the testing and validation of the system and shall provide certification that their respective system portions meet its contractual requirements.

3.2 TESTING AND TRAINING

All testing and training shall be compliant with the VA General Requirements, Section 01 00 00, GENERAL REQUIREMENTS.

-----END-----

SECTION 28 26 00
ELECTRONIC PERSONAL PROTECTION SYSTEM (EPPS)

PART 1 - GENERAL

1.1 DESCRIPTION

Provide and install complete Duress-Panic Alarms, Emergency Phones/ Call-Boxes, and Intercom Systems, hereafter referred to as EPPS System.

1.2 RELATED WORK

For firestopping application and use, Section 07 84 00, FIRESTOPPING.

For connections, Section 26 05 21, LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES (600 VOLTS AND BELOW).

For other communication systems, Section 27 05 11, REQUIREMENTS FOR COMMUNICATIONS INSTALLATIONS.

For grounding of equipment, Section 27 05 26, GROUNDING AND BONDING FOR COMMUNICATIONS SYSTEMS.

For infrastructure, Section 26 05 33, RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS.

For cabling requirements, Section 27 15 00, COMMUNICATIONS HORIZONTAL CABLING.

For security cameras, Section 28 23 00, VIDEO SURVEILLANCE.

For monitoring of equipment, Section 28 13 16, ACCESS CONTROL SYSTEM AND DATABASE MANAGEMENT.

For Warranty of Construction see GENERAL CONDITIONS.

For General Requirements, Section 01 00 00, GENERAL REQUIREMENTS.

1.3 QUALITY ASSURANCE

The Contractor shall be responsible for providing, installing, and the operation of the EPPS System as shown. The Contractor shall also provide certification as required.

The security system shall be installed and tested to ensure all components are fully compatible as a system and can be integrated with all associated security subsystems, whether the security system is stand-alone or a part of a complete Information Technology (IT) computer network.

The Contractor or security sub-contractor shall be a licensed security Contractor as required within the state or jurisdiction of where the installation work is being conducted.

1.4 SUBMITTALS

Submit below items in conjunction with Master Specification Sections 01 33 23, SHOP DRAWING, PRODUCT DATA, AND SAMPLES, and Section 02 41 00, DEMOLITION.

Provide certificates of compliance with Section 1.3, Quality Assurance. Provide a pre-installation and as-built design package in both electronic format and on paper, minimum size 48 x 48 inches (1220 x 1220 millimeters); drawing submittals shall be per the established project schedule.

Pre-installation design and as-built packages shall include, but not be limited to:

1. Index Sheet that shall:

Define each page of the design package to include facility name, building name, floor, and sheet number.

Provide a list of all security abbreviations and symbols.

Reference all general notes that are utilized within the design package.

Specification and scope of work pages for all security systems that are applicable to the design package that will:

Outline all general and job specific work required within the design package.

Provide a device identification table outlining device Identification (ID) and use for all security systems equipment utilized in the design package.

2. Drawing sheets that will be plotted on the individual floor plans or site plans shall:

Include a title block as defined above.

Define the drawings scale in both standard and metric measurements.

Provide device identification and location.

Address all signal and power conduit runs and sizes that are associated with the design of the electronic security system and other security elements (e.g., barriers, etc.).

Identify all pull box and conduit locations, sizes, and fill capacities.

Address all general and drawing specific notes for a particular drawing sheet.

3. A riser drawing for each applicable security subsystem shall:
 - Indicate the sequence of operation.
 - Relationship of integrated components on one diagram.
 - Include the number, size, identification, and maximum lengths of interconnecting wires.
 - Wire/cable types shall be defined by a wire and cable schedule. The schedule shall utilize a lettering system that will correspond to the wire/cable it represents (example: A = 18 AWG/1 Pair Twisted, Unshielded). This schedule shall also provide the manufacturer's name and part number for the wire/cable being installed.
 4. A system drawing for each applicable security system shall:
 - Identify how all equipment within the system, from main panel to device, shall be laid out and connected.
 - Provide full detail of all system components wiring from point-to-point.
 - Identify wire types utilized for connection, interconnection with associate security subsystems.
 - Show device locations that correspond to the floor plans.
 - All general and drawing specific notes shall be included with the system drawings.
 5. A schedule for all of the applicable security subsystems shall be included. All schedules shall provide the following information:
 - Device ID.
 - Device Location (e.g. site, building, floor, room number, location, and description).
 - Mounting type (e.g. flush, wall, surface, etc.).
 - Power supply or circuit breaker and power panel number.
 6. Detail and elevation drawings for all devices that define how they were installed and mounted.
- E. Pre-installation design packages shall be reviewed by the Contractor along with a VA representative to ensure all work has been clearly defined and completed. All reviews shall be conducted in accordance with the project schedule. There shall be four (4) stages to the review process:
- 35 percent
 - 65 percent
 - 90 percent

4. 100 percent

Provide manufacturer security system product cut-sheets. Submit for approval at least 30 days prior to commencement of formal testing, a Security System Operational Test Plan. Include procedures for operational testing of each component and security subsystem, to include performance of an integrated system test.

Submit manufacture's certification of Underwriters Laboratories, Inc. (UL) listing as specified. Provide all maintenance and operating manuals per the VA General Requirements, Section 01 00 00, GENERAL REQUIREMENTS.

1.5 PUBLICATIONS

The publications listed below (including amendments, addenda, revisions, supplement, and errata) form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.

American National Standards Institute (ANSI):

ANSI S3.2-99Method for measuring the Intelligibility of
Speech over Communications Systems

Department of Justice American Disability Act (ADA)

28 CFR Part 36ADA Standards for Accessible Design

National Fire Protection Association (NFPA):

70-05National Electrical Code

National Electrical Manufacturers Association (NEMA)

250-03Enclosures for Electrical Equipment (1000 Volts
Maximum)

Underwriters Laboratories, Inc. (UL):

305-00Standard for Panic Hardware

444-02Communications Cables

636-95Standard for Holdup Alarm Units and Systems

Uniform Federal Accessibility Standards (UFAS), 1984

1.6 WARRANTY OF CONSTRUCTION.

Warrant EPPS System work subject to the Article "Warranty of Construction" of FAR clause 52.246-21.

PART 2 - PRODUCTS

2.1 EQUIPMENT AND MATERIALS

A. General:

All equipment shall be rated for continuous operation.

Environmental conditions (i.e. temperature, humidity, wind, and seismic activity) shall be taken under consideration at each facility and site location prior to installation of the equipment.

All equipment shall operate on a 120 or 240 volts alternating current (VAC); 50 hertz (Hz) or 60 Hz Alternating Current (AC) power system unless documented otherwise in subsequent sections listed within this spec. All equipment shall have a battery back-up source of power that will provide 12 hours (hrs.) of run time in the event of a loss of primary power to the security systems until a backup generator comes on-line.

The EPPS systems shall be designed, installed, and programmed in a manner that will allow for easy of operation, programming, servicing, maintenance, testing, and upgrading of the system.

All EPPS components located in designated "HAZARDOUS ENVIRONMENT" areas where fire or explosion could occur due to the presence of natural gases or vapors, flammable liquids, combustible residue, or ignitable fibers or debris, shall be rated Class II, Division I, Group F, and installed in accordance with National Fire Protection Association (NFPA) 70, National Electrical Code Chapter 5.

The Contractor shall provide the Contracting Officer with written verification, that the type of wire/cable being provided is recommended and approved by the OEM. Cabling shall meet the interconnecting wiring requirements of NFPA 70, National Electrical Code. The Contractor is responsible for providing the correct protection cable duct and/or conduit and wiring.

When interfacing with other communications or security subsystems the Contractor shall utilize interfacing methods that are approved by the Contracting Officer. At a minimum, an acceptable interfacing method requires not only a physical and mechanical connection; but also a matching of signal, voltage, and processing levels with regard to signal quality and impedance. The interface point must adhere to all standards described herein.

Systems shall be scaleable, not vendor specific, and allow expansion as required.

Wireless systems shall use ultrasonic, infrared and radio frequency waves to link distributed transmitters and receivers. Specific characteristics of particular facility will determine best application. Contractor is responsible for determining best system using prediction program to determine where readable signals can be obtained and identify "dead spots".

All hardwired alarms, switches, and junction boxes shall be protected from tampering and include line supervision.

The installation and placement of intercom units and emergency-call boxes in strategic locations shall also require that signage be posted near these devices. The signage, in accordance with Section 10 14 00, SIGNAGE shall communicate the location of the device and its unique identification number, and brief instruction on how to access/use the device. The signage may appear on the device, on a pole or wall near the device location and shall be printed in a manner that is easily read during daylight and hours of darkness.

2.2 EQUIPMENT ITEMS

All systems shall be designed to provide continuous electrical supervision of the complete and entire system.

Noise filters and surge protectors shall be provided for all intercommunications equipment to ensure protection from primary AC power surges and to ensure noise interference is not induced into low voltage data circuits.

All alarm and initiating and signaling circuits shall be supervised for open circuits, short circuits, and system grounds. Main and Uninterrupted Power Supply (UPS) power circuits shall be supervised for any change in operating conditions (e.g. low battery, primary to back up battery, and UPS online). When an open, short or ground occurs in any system circuit, an audible and visual fault alarm signal shall be initiated at the master control station and all remote locations.

Control Unit: Shall consist of the components to constantly monitor and verify alarm activation; identify zone of activation and location of activation.

Audible Signal Device for Duress-Panic: Provides alarm activation and audible sound for alarms, as well as supervisory and trouble signals that shall be distinctive.

- F. Assessment: This capability shall consist of electronic devices required to visually and audibly verify the validity of alarms. Assessment also includes providing indication of tampering, fail-safe, low battery, and power losses.
- G. Alarm Monitoring and Reporting: Shall annunciate information to at least two (2) separate locations. The alarms shall maintain the capability to respond with local and remote visible and audible signals upon activation of an alarm. The alarms shall have the capability of operating in a silent mode, alerting personnel monitoring the system that the device has been activated.
- H. The intercom and emergency call-box systems shall be provided with normally acceptable speech intelligibility, defined as a score of at least 70% in accordance with ANSI S3.2
- I. Master Stations for Emergency Call Box and Security Intercoms:
All master stations shall have a "call-in" switch to provide an audible and visual indication of incoming calls from remote stations. Individual visual indication shall identify the calling station and status, and remain actuated until a call is answered by a master station.
Master stations shall be equipped with a handset with a switch for private conversations.
Intercom master stations shall also have an all-call feature, and have the ability to receive video from a video intercom unit.
Master stations shall have the capability to selectively communicate with any remote station by actuating assigned station number on a keypad or select button for that station.
Master stations may be standalone or can be integrated with the Access Control System and Database Management. The Contractor will be responsible for the integration of the Master station with the Access Control System and Database Management in accordance with OEM instructions and Section 28 13 16, ACCESS CONTROL SYSTEM AND DATABASE MANAGEMENT.
- J. Duress-Panic Alarms:
1. Housing shall be a rugged corrosion-resistant housing of stainless steel or Acrylonitrile Butadiene Styrene (ABS) molded plastic or similar material that is weather and dust proof.

2. Actuating device shall include a minimum of a plunger button whose head is recessed from the face/front edge of the housing and be designed to avoid accidental activation using switch guard or multiple buttons (i.e., requires pressing two (2) buttons simultaneously)
3. Wireless stationary devices will meet the same specifications as Personal Duress/Panic Alarms.
4. Alarm switch/button shall lock-in upon activation until manually reset with key or manufacture provided device.
5. The switch shall be a positive-acting, double-pole, and double-throw switch.
6. Duress/Panic alarms shall meet UL 305 Standard for Panic Alarms. To reduce the possibility of false alarms and ensure installation functionality UL 636 Standard for Holdup Alarms standards shall be met.
7. Alarms used for concealed application requires silent alarm notification to a monitoring station. They shall annunciate at the Access Control System and Database Management, monitored by a central station or direct connect to local police, depending on local ordinance requirements.
8. Shall be capable of being mounted for hand or foot use in a manner that is unable to be viewed by the public. Larger systems use a computer that intercepts and processes alarms and displays them on a monitor. The central computer can make an announcement over facility hand held radios, pagers or telephones, or at the Access Control System and Database Management so that the other security personnel can be immediately notified. These systems shall be hardwired.
9. Components:
 - Transmitter
 - Locator subsystem
 - Receiver
 - Software
10. Wiring will be four (4) conductor #18 American Wire Gauge (AWG).

11. Duress-Panic Alarm Technical Characteristics:

Temperature Range	0° to 110°F (-17.8°C to 43.3°C)
Nominal Voltage	12 V DC @ 6 mA
Current	Max 8 mA
Operational Voltage	7 V DC to 15 V DC
Operational life	Rated for 0,000 activations
Battery Activations	500
Actuator	Dual button plunger with activation lock
LED	Bi-color - on and activated

K. Personal Duress-Panic Alarm:

1. These systems are wireless only and can be worn as a belt clip, with a neck lanyard or with a wrist band. These alarms can be either active (manually operated) or passive mode (if detached from body, or body position changes to a prone position) alarm activates. They also provide identification of individual and location.
2. Components:
 - Transmitter
 - Repeaters (for wireless and increase distance)
 - Locator subsystem
 - Receiver
 - Software
3. Wireless transmitters shall send a periodic check in signal to the main computer or processor. If the signal is not received according to a definable time window, a supervisory alert will be generated. Wireless devices shall report a low battery condition well in advance to the failure of the battery.
4. Shall consist of a compact lightweight transmitter enclosed in a durable fire-retardant ABS plastic case that can be easily worn.
5. Transmitters may use ultrasonic, radio frequency (RF), or infrared (IR) to transmit signals. Each has advantages and disadvantages. Selection of system shall be dependent on defined usage and range of communications required.
6. Sensors shall be adjustable to activate automatically when mounted on a belt and the user is in a horizontal position for longer than one (1) to fifteen (15) minutes. Adjustment capability shall not be accessible to personnel wearing the panic alarm device.

Radio frequencies for transmitter will comply with Federal Communication Commission (FCC) regulations.

Radio frequency transmitters will use frequency modulation signal hopping.

Personal Duress-Panic Alarm Technical Characteristics:

Temperature Range	0° to 110°F (-17.8°C to 43.3°C)
Nominal Voltage	12 V DC @ 6 mA
Current	Max 8 mA
Operational Voltage	7 V DC to 15 V DC
Battery Life	Regular battery 60 hour duration or Nickel-Metal Hydride (NiMH) rechargeable 12 hrs. 20 hr. per charge
Battery Lifespan	500 activations
Actuator	Plunger with activation lock
LED	Bi-color - on and activated
Passive Activation	Adjustable Prone position 1-15 minutes

L. Emergency Call Box Enclosures:

Consist of remote call stations, master station and a telephone Private Branch Exchange (PBX). They shall have two-way voice communications. Calls are directed to a pre-programmed extension. These systems are effective for a multi-facility environment or stand-alone facility with a parking structure or large parking lot. In addition, they may contain built-in CCTV system capabilities or can be integrated to work with standalone CCTV systems.

Emergency Call Boxes will be housed in an National Electric Manufactures Association (NEMA) 250 Enclosures for Electrical Equipment compliant enclosures. Call-box enclosure shall include blue light/or similar strobe mounted behind or on top of the call box: A blue light or color lit strobe shall be activated (e.g. to inform others visually that assistance is required) when the emergency switch/button/phone is pressed/taken off-hook and shall flash for the duration of a call.

The faceplate shall be constantly lit by ultra bright LEDs.

Enclosure and bracket system shall be designed to resist extreme weather conditions and constructed of weather resistant stainless steel.

Emergency Call Box Enclosure Technical Characteristics:

Construction	Minimum 11 gauge stainless steel Impact resistant polycarbonate window for lights
Mounting	Wall, pole or kiosk
Power	120 VAC: 44 Watts Maximum or 24 VDC: 18 Watts Maximum
Lighting	Strobe: 1.5 million candlepower 70 flashes per minute. Blue Light: 7 watt high efficiency 10,000 hour compact fluorescent. Faceplate Light: Ultra bright LEDs 100,000 hour lifetime.

M. Emergency Call Boxes:

Emergency Call Box shall be indoor/outdoor-rated, Uniform Federal Accessibility Standards (UFAS) and Americans with Disability Act (ADA) compliant, and provide hands-free usage. Phone shall also include cast metal raised letter and Braille signage for UFAS/ADA compliance.

Emergency Call Box shall include built-in auto-dialer that dials two (2) numbers: if first number doesn't answer, automatically dials a second number.

The System shall include auto-answer to allow for monitoring and initiating calls with an Emergency Phone.

Emergency Call Box shall use flush mount enclosure (FME,) shall include two (2) piece housing construction with full front lip to allow tight gasket seal between the speakerphone and enclosure. Screws shall be tamper free.

When activated the Emergency Call Box shall automatically place a call to the pre-programmed number(s). If the number is busy it should automatically call a second number.

The electronics enclosure shall be capable of using interchangeable faceplates: a single-button faceplate, a two-button faceplate, or a two-button faceplate with keypad.

7. The system shall use a "plain old telephone service" (POTS) line or analog PBX and shall be capable of integration with existing CCTV and Access Control System and Database Management via software at the SMS head-end.
8. Depending on distance and existing phone line capabilities, RF or use of wireless phone connections may be considered. The Contractor and Contracting Officer shall select appropriate system based on facility telecommunication system capabilities and desired system requirements.
9. Monitoring/Diagnostic capability at control and monitoring stations shall include the capability to automatically poll each Emergency Call Box, report incoming calls, identify location, and keep permanent records of all events with the use of a Windows based compatible software package and shall also meet the requirements of the Security Management System (SMS).
10. If speaker/handset stations are used, lifting the handset shall automatically cut out the loudspeaker in the station and all conversation shall be carried through the handset. Where noise does not exceed 55 dB, hands-free operations may be performed from distances up to 20 feet (ft.) (6.096 m). In higher noise environments only a talk-listen switch shall be utilized.
11. If system is a hardware type master station it shall be capable of:
LED display of identification code for emergency phones;
Indicate whether call was initiated by pushing button or by an auxiliary device;
Include RJ11 ports for connection to telephone line and standard telephone; and
Powered by 9 VDC, 500mA power supply that connects to 120 volt alternating current (VAC).
12. System shall include auto-answer to allow security to monitor and initiate calls with Emergency Call Box.
13. Contractor shall provide the capability to connect up to 8 phones on one (1) phone line while retaining ability to call each phone individually and without affecting performance. System shall also be able to create a closed system without need for any phone lines.
14. The System shall include the capability to record a message identifying the location of the caller.

It shall remotely be able to adjust speakerphone & microphone sensitivity.

Emergency Call Box Technical Characteristics:

Construction	12 gauge (2.8mm)#4 brushed stainless steel face plate
Operating Temperature	-4°F to +149°F (-20°C to +65°C)
Communication	2-way hands-free communication
Digital Capacity	Up to 18 digits, including pauses, for each of two (2) phone numbers
Dialing Speed	Minimum 10 tones per second
Power Source	Phone line powered (requires 20mA at 24 v off-hook)
Connection	Parallel tip and ring connected to RJ11 connector for quick installation
Memory	Erasable Programmable Read-only Memory (EPROM)
Circuit Protection	Lightening suppressed and full wave polarity guarded
Programming	Non-volatile EEPROM programming can be done from any telephone. No battery back-up needed
Wiring Requirements	1 twisted-shielded pair (gauge depends on distance)
Camera	Option for pin-hole color camera or Integration with existing CCTV
LED	Call confirmation
Activation	Sound or 1.5 in. minimum piezoelectric button
Labeling	"Push for Help" or "Emergency"

N. Strobes and Beacon:

Used for visual recognition of device activation once an emergency phone or intercom is activated. They provide unit identification and quick location of the caller.

Strobes and Beacons Technical Characteristics:

STROBE	
Input Voltage	10.5 - 28 VDC or VAC
Input Current	Average 1 amp
Input Current	Peak 3 amp
Intensity	1,000,000 candlepower
Control Circuit Output	2 mA max
Flash Rate	60 - 75 times per minute
BEACON	
Input Voltage	10.5 - 28 VAC or VDC
Input Current	@24.0 : 427 MA

O. Security Intercoms:

Shall be utilized to assist in controlling entry to a site, parking lot, facility, main and alternate entries, loading dock areas. They are also used for emergencies. These systems shall have both two-way voice communications and video (CCTV) capabilities built in. Intercoms may also have key-pads that allow for specific call connections or may provide a directory. These systems consist of both remote and master stations. Intercom shall be externally powered for distances over 1,500 feet (457.2 meters) (m) from the master control unit.

The Intercom shall be programmable from a remote location and have a three number dialing capability per activation button, or include a keypad for dialing authorized and published extensions.

The Intercom shall have an internally mounted electronics enclosure and auxiliary power.

The Contractor shall be responsible for integration of intercom with auxiliary output to electronic or magnetic door releases, as well as CCTV, as required.

Security Intercom Technical Characteristics:

Construction	12 gauge (2.8mm)#4 brushed stainless steel face plate
Operating Temperature	-4°F to +149°F (-20°C to +65°C)
Communication	2-way hands-free communication
Digital Capacity	Up to 18 digits, including pauses, for

	each of two (2) phone numbers
Dialing Speed	Minimum 10 tones per second
Power Source	Phone line powered or PBX
Connection	Parallel tip and ring connected to RJ11 connector for quick installation
Memory	EPROM
Circuit Protection	Lightening suppressed and full wave polarity guarded
Programming	Non-volatile EEPROM programming can be done from any telephone. No battery back-up needed
Wiring Requirements	1 twisted-shielded pair (gauge depends on distance)
Camera	Option for pin-hole color camera or Integration with existing CCTV
LED	Call confirmation
Activation	1.5 in. (38.1mm) minimum piezoelectric button
Labeling	"Information" or "Help"

2.3 INSTALLATION KIT

General: A kit shall be provided that, at a minimum, includes all connectors and terminals, labeling systems, barrier strips, wiring blocks or wire wrap terminals, heat shrink tubing, cable ties, solder, hangers, clamps, bolts, etc., required to accomplish a neat and secure installation. Unfinished or unlabeled wire connections will not be allowed. Contractor shall turn over to the Contracting Officer all unused and partially opened installation kit boxes, coaxial cable reels, conduit, cable tray, and/or cable duct bundles, wire rolls, and physical installation hardware. This is an acceptable alternate to the individual spare equipment requirement as long as the minimum spare items are provided in this count. The following installation sub-kits are required as a minimum:

System Grounding:

1. The grounding kit shall include all cable in accordance with UL 444 Communications Cables, and installation hardware required. All grounding will be according to the NEC.

2. This includes, but is not limited to:

Coaxial Cable Shields

Control Cable Shields

Data Cable Shields

Conduits

Cable Duct

Power Panels

Connector Panels

Coaxial Cable: The coaxial cable kit shall include all coaxial connectors, cable tying straps, heat shrink tabbing, hangers, clamps, etc., required to accomplish a neat and secure installation.

Wire And Cable: The wire and cable kit shall include all connectors and terminals, barrier straps, wiring blocks, wire wrap strips, heat shrink tubing, tie wraps, solder, hangers, clamps, labels etc., required to accomplish a neat and orderly installation.

Equipment Interface: The equipment interface kit shall include any item or quantity of equipment, cable, mounting hardware and materials needed to interface Systems and Subsystems according to the OEM requirements and this specification.

Labels: The labeling kit shall include any item or quantity of labels, tools, stencils, and materials needed to label each subsystem according to the OEM requirements, as-installed drawings, and this specification.

Documentation: The documentation kit shall include any item or quantity of items, computer discs, as installed drawings, equipment, maintenance, and operation manuals, and OEM materials needed to correctly provide the system documentation as required by this document and explained herein.

PART 3 - EXECUTION

3.1 INSTALLATION

System installation shall be installed in accordance with NFPA 731 Standards for the Installation of Electric Premises Security Systems and appropriate installation manual for each type of subsystem designed, engineered, and installed.

The location and type of duress, intercom, or call-box to be installed will be in accordance with physical security requirements unique to each VA facility.

For EPPS systems (i.e. use current panic/duress and emergency call boxes) that can operate through existing VA facility telephone system lines, software programming and hardware, refer to Section 27 51 23, INTERCOMMUNICATIONS AND PROGRAM SYSTEMS to integrate additional EPPS equipment.

Concealed duress/panic devices shall be mounted in such a way that their location is only known by the person having knowledge of the activating device location. No wiring shall be exposed to identify the location of the activation device.

Floor mounted duress alarms shall be attached to millwork on floor.

When mounted under millwork, wiring shall be routed in millwork to conduit system via flexible conduit.

Hard-wired switches shall be wired to individual alarm points within the Advanced Processing Controller (apC).

Wall and post mounted stations shall be mounted to meet UFAS/ADA requirements and use tamper proof bolts and screws. Testing will be finished before installation of fasteners.

Cleaning: Subsequent to installation, clean each system component of dust, dirt, grease, or oil incurred during installation in accordance to manufacture instructions.

Provisions shall be made for systems in high-noise areas or areas with electrical interference environments.

Adjustment/Alignment/Synchronization: Contractor shall prepare for system activation by following manufacturer's recommended procedures for adjustment, alignment, or programming. Prepare each component in accordance with appropriate provisions of the component's installation, operations, and maintenance instructions.

3.2 TESTS AND TRAINING

All testing and training shall be compliant with the VA General Requirements, Section 01 00 00, GENERAL REQUIREMENTS.

--- END----

THIS PAGE INTENTIONALLY LEFT BLANK

**SECTION 28 31 00
FIRE DETECTION AND ALARM**

PART 1 - GENERAL

1.1 DESCRIPTION

Work in this section shall be performed by the current VA fire alarm maintenance contractor. Contact COTR for current contractor authorized to perform this work.

This section of the specifications includes the furnishing, installation, and connection of the fire alarm equipment to form a complete coordinated system ready for operation. It shall include, but not be limited to, alarm initiating devices, alarm notification appliances, control units, fire safety control devices, annunciators, power supplies, and wiring as shown on the drawings and specified.

Fire alarm systems shall comply with requirements of NFPA 72 unless variations to NFPA 72 are specifically identified within these contract documents by the following notation: "variation". The design, system layout, document submittal preparation, and supervision of installation and testing shall be provided by a technician that is certified NICET level III or a registered fire protection engineer. The NICET certified technician shall be on site for the supervision and testing of the system. Factory engineers from the equipment manufacturer, thoroughly familiar and knowledgeable with all equipment utilized, shall provide additional technical support at the site as required by the COTR or his authorized representative. Installers shall have a minimum of two years experience installing fire alarm systems.

Fire alarm signals:

1. Building's 121 and 122 shall have a general evacuation fire alarm signal in accordance with ASA S3.41 to notify all occupants in the respective building to evacuate.

Alarm signals (by device), supervisory signals (by device) and system trouble signals (by device not reporting) shall be distinctly transmitted to the network command center in Building 50 Engineering Office via fiber optics communication.

The main fire alarm control unit shall automatically transmit alarm signals to a listed central station using a digital alarm communicator transmitter in accordance with NFPA 72.

1.2 SCOPE

- A. A new fire alarm system shall be designed and installed in accordance with the specifications and drawings. Device location shown on the

drawings are for reference only unless specifically dimensioned. Actual locations shall be in accordance with NFPA 72 and this specification. The design, materials, equipment, installation, inspection, and testing of the fire alarm system shall be in accordance with the required and advisory provision of NFPA 72 and Underwriters Laboratories, Inc.

Basic Performance:

Signaling line circuits connecting building fire alarm control panels shall be wired in accordance with NFPA 72, Table 3-6.1 Style 5.

Signaling line circuits within buildings shall be wired in accordance with NFPA 72, Table 3-6.14, Style 1.

Initiating device circuits shall be wired in accordance with NFPA 72, Table 3-5.1, Style C.

Notification circuits shall be wired in accordance with NFPA 72, Table 3-7.1, Style Y.

Alarms, supervisory and trouble signals from each building fire alarm control panel shall be encoded by UL listed electronic devices onto the fiber optics communication network.

1.3 RELATED WORK

- A. Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES: Procedures for submittals.
 - B. Section 07 84 00, FIRESTOPPING: Fire proofing wall penetrations.
 - C. Section 08 71 00, DOOR HARDWARE: Combination Closer-Holder.
 - D. Section 09 91 00, PAINTING: Painting for equipment and existing surfaces.
 - E. Section 21 13 13, WET-PIPE SPRINKLER SYSTEMS: Sprinkler systems.
 - F. Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS: General electrical requirements for items which are common to other Division 26 sections.
- Section 26 05 33, RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS: Conduits and boxes for cables/wiring.
- Section 26 05 21, LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES (600 VOLTS AND BELOW: Cables/wiring.
- Section 27 15 00, COMMUNICATIONS HORIZONTAL CABLING; FIBER OPTIC CABLE.

1.4 SUBMITTALS

General: Submit 4 copies and 1 reproducible in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES, and Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS.

Drawings:

1. Prepare drawings using AutoCAD and include all contractors information. Layering shall be by VA criteria as provided by the Contracting Officer's Technical Representative (COTR). Bid drawing

files on AutoCAD will be provided to the Contractor at the pre-construction meeting. The contractor shall be responsible for verifying all critical dimensions shown on the drawings provided by VA.

Floor plans: Provide locations of all devices (with device number at each addressable device corresponding to control unit programming), appliances, panels, equipment, junction/terminal cabinets/boxes, risers, electrical power connections, individual circuits and raceway routing, system zoning; number, size, and type of raceways and conductors in each raceway; conduit fill calculations with cross section area percent fill for each type and size of conductor and raceway. Only those devices connected and incorporated into the final system shall be on these floor plans. Do not show any removed devices on the floor plans. Show all interfaces for all fire safety functions.

Riser diagrams: Provide, for the entire system, the number, size and type of riser raceways and conductors in each riser raceway and number of each type device per floor and zone. Show door holder interface, elevator control interface, HVAC shutdown interface, fire extinguishing system interface, and all other fire safety interfaces. Show wiring Styles on the riser diagram for all circuits. Provide diagrams both on a per building and campus wide basis.

Detailed wiring diagrams: Provide for control panels, modules, power supplies, electrical power connections, auxiliary relays and annunciators showing termination identifications, size and type conductors, circuit boards, LED lamps, indicators, adjustable controls, switches, ribbon connectors, wiring harnesses, terminal strips and connectors, spare zones/circuits. Diagrams shall be drawn to a scale sufficient to show spatial relationships between components, enclosures and equipment configuration.

Two weeks prior to final inspection, the Contractor shall deliver to the COTR one (1) set of reproducible, as-built drawings, two blue-line copies and one (1) set of the as-built drawing computer files (using AutoCAD). As-built drawings (floor plans) shall show all new and existing conduit used for the fire alarm system.

C. Manuals:

1. Submit simultaneously with the shop drawings, companion copies of complete maintenance and operating manuals including technical data sheets for all items used in the system, power requirements, device wiring diagrams, dimensions, and information for ordering replacement parts.

- Wiring diagrams shall have their terminals identified to facilitate installation, operation, expansion and maintenance.
- Wiring diagrams shall indicate internal wiring for each item of equipment and the interconnections between the items of equipment.
- Include complete listing of all software used and installation and operation instructions including the input/output matrix chart.
- Provide a clear and concise description of operation that gives, in detail, the information required to properly operate, inspect, test and maintain the equipment and system. Provide all manufacturer's installation limitations including but not limited to circuit length limitations.
- Provide standby battery calculations under normal operating and alarm modes. Battery calculations shall include the magnets for holding the doors open for one minute.
- Include information indicating who will provide emergency service and perform post contract maintenance.
- Provide a replacement parts list with current prices. Include a list of recommended spare parts, tools, and instruments for testing and maintenance purposes.
- A computerized preventive maintenance schedule for all equipment. The schedule shall be provided on disk in a computer format acceptable to the VAMC and shall describe the protocol for preventive maintenance of all equipment. The schedule shall include the required times for systematic examination, adjustment and cleaning of all equipment. A print out of the schedule shall also be provided in the manual. Provide the disk in a pocket within the manual.
- Furnish manuals in 3 ring loose-leaf binder or manufacturer's standard binder.
- A print out for all devices proposed on each signaling line circuit with spare capacity indicated.
2. Two weeks prior to final inspection, deliver four copies of the final updated maintenance and operating manual to the COTR. The manual shall be updated to include any information necessitated by the maintenance and operating manual approval.
- Complete "As installed" wiring and schematic diagrams shall be included that shows all items of equipment and their interconnecting wiring. Show all final terminal identifications.
- Complete listing of all programming information, including all control events per device including an updated input/output matrix.

Certificate of Installation as required by NFPA 72 for each building. The certificate shall identify any variations from the National Fire Alarm Code.

Certificate from equipment manufacturer assuring compliance with all manufacturers installation requirements and satisfactory system operation.

Certifications:

Together with the shop drawing submittal, submit the technician's NICET level III fire alarm certification as well as certification from the control unit manufacturer that the proposed performer of contract maintenance is an authorized representative of the major equipment manufacturer. Include in the certification the names and addresses of the proposed supervisor of installation and the proposed performer of contract maintenance. Also include the name and title of the manufacturer's representative who makes the certification.

Together with the shop drawing submittal, submit a certification from either the control unit manufacturer or the manufacturer of each component (e.g., smoke detector) that the components being furnished are compatible with the control unit.

Together with the shop drawing submittal, submit a certification from the major equipment manufacturer that the wiring and connection diagrams meet this specification, UL and NFPA 72 requirements.

1.5 WARRANTY

All work performed and all material and equipment furnished under this contract shall be free from defects and shall remain so for a period of five (5) years from the date of acceptance of the entire installation by the COTR.

1.6 GUARANTEE PERIOD SERVICES

Complete inspection, testing, maintenance and repair service for the fire alarm system shall be provided by a factory trained authorized representative of the manufacturer of the major equipment for a period of five years from the date of acceptance of the entire installation by the COTR.

Contractor shall provide all necessary test equipment, parts and labor to perform required inspection, testing, maintenance and repair.

All inspection, testing, maintenance and permanent records required by NFPA 72, and recommended by the equipment manufacturer shall be provided by the contractor. Work shall include operation of sprinkler system alarm and supervisory devices as well as all reused existing equipment connected to the fire alarm system. It shall include all interfaced

equipment including but not limited to elevators, HVAC shutdown, and extinguishing systems.

Maintenance and testing shall be performed in accordance with NFPA 72. A computerized preventive maintenance schedule shall be provided and shall describe the protocol for preventive maintenance of equipment. The schedule shall include a systematic examination, adjustment and cleaning of all equipment.

Non-included Work: Repair service shall not include the performance of any work due to improper use, accidents, or negligence for which the contractor is not responsible.

Service and emergency personnel shall report to the Engineering Office or their authorized representative upon arrival at the hospital and again upon the completion of the required work. A copy of the work ticket containing a complete description of the work performed and parts replaced shall be provided to the COTR or his authorized representative.

Emergency Service:

Warranty Period Service: Service other than the preventative maintenance, inspection, and testing required by NFPA 72 shall be considered emergency call-back service and covered under the warranty of the installation during the first year of the warranty period, unless the required service is a result of abuse or misuse by the Government. Written notification shall not be required for emergency warranty period service and the contractor shall respond as outlined in the following sections on Normal and Overtime Emergency Call-Back Service. Warranty period service can be required during normal or overtime emergency call-back service time periods at the discretion of the Contracting Officer or his authorized representative.

Normal and overtime emergency call-back service shall consist of an on-site response within two hours of notification of a system trouble.

Normal emergency call-back service times are between the hours of 7:30 a.m. and 4:00 p.m., Monday through Friday, exclusive of federal holidays. Service performed during all other times shall be considered to be overtime emergency call-back service. The cost of all normal emergency call-back service for years 2 through 5 shall be included in the cost of this contract.

Overtime emergency call-back service shall be provided for the system when requested by the Government. The cost of the first 40 manhours per year of overtime call-back service during years 2 through 5 of this contract shall be provided under this contract. Payment for overtime emergency call-back service in excess of the 40 man hours

per year requirement will be handled through separate purchase orders. The method of calculating overtime emergency call-back hours is based on actual time spent on site and does not include travel time.

The contractor shall maintain a log at each fire alarm control unit. The log shall list the date and time of all examinations and trouble calls, condition of the system, and name of the technician. Each trouble call shall be fully described, including the nature of the trouble, necessary correction performed, and parts replaced.

In the event that VA modifies the fire alarm system post-Acceptance but during the five year Guarantee Period Service period, Contractor shall be required to verify that the system, as newly modified or added, is consistent with the manufacturer's requirements; any verification performed will be equitably adjusted under the Changes clause. The post-Acceptance modification or addition to the fire alarm system shall not void the continuing requirements under this contract set forth in the Guarantee Period Service provision for the fire alarm system as modified or added. The contract will be equitably adjusted under the Changes clause for such additional performance.

1.7 APPLICABLE PUBLICATIONS

The publications listed below (including amendments, addenda, revisions, supplements and errata) form a part of this specification to the extent referenced. The publications are referenced in text by the basic designation only.

National Fire Protection Association (NFPA):

70-2008 National Electrical Code (NEC).

72-2007 National Fire Alarm Code.

90A-2009 Installation of Air Conditioning and Ventilating Systems.

101-2003 Life Safety Code

Underwriters Laboratories, Inc. (UL):

2000-2009 Fire Protection Equipment Directory

Factory Mutual Research Corp (FM): Approval Guide, 2005 Edition

American National Standards Institute (ANSI):

S3.41-2008 Audible Emergency Evacuation Signal

International Code Council, International Building Code (IBC) 2006 Edition

PART 2 - PRODUCTS

2.1 EQUIPMENT AND MATERIALS, GENERAL

A. All equipment and components shall be new and the manufacturer's current model. All equipment shall be tested and listed by Underwriters

Laboratories, Inc. or Factory Mutual Research Corporation for use as part of a fire alarm system. The authorized representative of the manufacturer of the major equipment shall certify that the installation complies with all manufacturer's requirements and that satisfactory total system operation has been achieved.

2.2 CONDUIT, BOXES, AND WIRE

- A. Conduit shall be in accordance with Section 26 05 33, RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS and as follows:

All new and reused conduit shall be installed in accordance with NFPA 70.

Conduit fill shall not exceed 40 percent of interior cross sectional area.

All new conduit shall be 19 mm (3/4 inch) minimum.

B. Wire:

1. Wiring shall be in accordance with NEC article 760, Section 26 05 21, LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES (600 VOLTS AND BELOW), and as recommended by the manufacturer of the fire alarm system. All wires shall be color coded. Number and size of conductors shall be as recommended by the fire alarm system manufacturer, but not less than 18 AWG for initiating device circuits and 14 AWG for notification device circuits.

EXISTING FIRE ALARM WIRING SCHEDULE			
SYMBOL	APPLICATION	WIRE SIZE /TYPE	DESCRIPTION
(SG)	SIGNATURE DATA LINE (1) RED+ (1) BLACK- IN RED OUTER JACKET	#16AWG / FPLR PAIR	ADDRESSABLE DEVICES, e.i. Pull Stations, Smoke & Heat Detectors, Key Test Stations, etc.
(UG SG)	UNDER GROUND SIGNATURE DATA LINE	(1)RED+(1)BLACK-raceway. #12 STANDED / THHN/THWN	ADDRESSABLE CIRCUITRY leaving one building to enter another building thru underground
(NAC)	AUDIBLE /VISUAL CIRCUIT (1) ORANGE+ (1) BROWN-	#12 STRANDED / THHN/THWN	NOTIFICATION DEVICES, e.i. Horns, Strobes, Horn/Strobes.
(UG NAC)	UNDER GROUND AUDIBLE / VISUAL CIRCUIT (1) ORANGE+ (1) BROWN-	#12 STRANDED / THHN/THW N	ADDRESSABLE CIRCUITRY leaving one bldg. to enter another bldg. thru underground raceway.
(NETA)	NETWORK AUDIO LOOP (1) RED+ (1) BLACK- IN BLUE OUTER JACKET	#16AWG / SH-FPLR PAIR	CIRCUITRY between FACP's with speakers.
(AR)	AUDIO RISER (1) RED+ (1) BLACK- IN BLACK OUTER JACKET	#14AWG / FPLR PAIR	CIRCUITRY from Amplifier to CC2 and from CC2 to CC2.
(SP)	SPEAKER CIRCUIT (1) WHITE+ (1) BLUE-	#12 STRANDED / THHN/THWN	NOTIFICATION DEVICES, Speakers only
(24VDC)	24VDC POWER (1) RED+ (1) BLACK-	#14 SOLID / THHN/THWN	24VDC CIRCUITRY from FACP to auxiliary modules.
(DM)	DOOR HOLDER POWER (1) YELLOW+ (1) PURPLE-	#14 SOLID / THHN/THWN	SPECIAL 24VDC CIRCUITRY from FACP to door magnetic holders.
(CONV)	CONVENTIONAL ZONE (1) PINK+ (1) TAN-	#14 SOLID / THHN/THWN	DRY CONTACTS, e.i. PIV's, Tampers, and Flows.
(LED)	SIGA-LED (LED) (1) GREEN+ (1) GRAY-	#14 SOLID / THHN/THWN	CIRCUITRY from Detectors to Remote LED.
(REMIC)	REMOTE MICROPHONE KEY (1) RED+ (1) BLACK- IN BLUE OUTER JACKET WITH RED BANDING	#14AWG / SH-FPLR PAIR	CIRCUITRY from ASU in FACP-85 to FACP-67 then cascade to FACP- 88/13 and FACP-27.
	REMOTE MIC. AUDIO (1) RED+ (1) BLACK- IN BLUE OUTER JACKET WITH GREEN BANDING	#14AWG / SH-FPLR PAIR	CIRCUITRY from ASU in FACP-85 to FACP-67 then cascade to FACP- 88/13 and FACP-27.
(NETD)	FIBER OPTIC NETWORK DATA ORANGE WITH STRIPE (IN) ORANGE (OUT)	2 PLENUM ZIP CORD NEC OFNR	FIBER from building breakout to building FACP.

Addressable circuits and wiring used for the multiplex communication loop shall be twisted and shielded unless specifically excepted by the fire alarm equipment manufacturer in writing.

Any fire alarm system wiring that extends outside of a building shall have additional power surge protection to protect equipment from physical damage and false signals due to lightning, voltage and current induced transients. Protection devices shall be shown on the submittal drawings and shall be UL listed or in accordance with written manufacturer's requirements.

All wire or cable used in underground conduits including those in concrete shall be listed for wet locations.

C. Fiber Optics:

Fiber optic cable shall be 62.5/125 or 50/125 multi-mode fiber (matching the manufacture of the existing fiber optic. All fiber optic cable underground shall be jacketed with insulation rated for underground use. All interior fiber optics shall be run in conduit.

All connectors shall be "LC" connectors.

D. Terminal Boxes, Junction Boxes, and Cabinets:

Shall be galvanized steel in accordance with UL requirements.

All new boxes shall be sized and installed in accordance with NFPA 70.

Covers shall be repainted red in accordance with Section 09 91 00, PAINTING and shall be identified with white markings as "FA" for junction boxes and as "FIRE ALARM SYSTEM" for cabinets and terminal boxes. Lettering shall be a minimum of 19 mm (3/4 inch) high.

Terminal boxes and cabinets shall have a volume 50 percent greater than required by the NFPA 70. Minimum sized wire shall be considered as 14 AWG for calculation purposes.

Terminal boxes and cabinets shall have identified pressure type terminal strips and shall be located at the base of each riser.

Terminal strips shall be labeled as specified or as approved by the COTR.

2.3 FIRE ALARM CONTROL UNIT

A. General:

Building shall be provided with a fire alarm control unit and shall operate as an independent zoned fire alarm system with peer to peer networking capability.

Each power source shall be supervised from the other source for loss of power.

All circuits shall be monitored for integrity.

4. Detect the operation of any signal initiating device and the area of alarm condition, and operate all alarm and designated auxiliary devices.
5. Visually and audibly annunciate any trouble condition including, but not limited to main power failure, grounds and system wiring derangement.
6. Fire alarm control panel shall transmit alarm information to the fiber optic network system. All points monitored shall be capable of being made available as a "public" point on the network.
7. A minimum of 4 levels of security access shall be provided with password protection. Levels are as follows:
 - Level 1 - Fire Alarm signal acknowledges and resets.
 - Level 2 - History Log Access.
 - Level 3 - Disabling and Enabling nodes or points and walk-test features.
 - Level 4 - Fire Alarm System Programming.
8. Transmit digital alarm information to the main fire alarm control unit.

B. Enclosure:

The control unit shall be housed in a cabinet suitable for both recessed and surface mounting. Cabinet and front shall be corrosion protected, given a rust-resistant prime coat, and manufacturer's standard finish.

Cabinet shall contain all necessary relays, terminals, lamps, and legend plates to provide control for the system.

C. Power Supply:

The control unit shall derive its normal power from a 120 volt, 60 Hz dedicated supply connected to the emergency power system. Standby power shall be provided by a 24 volt DC battery as hereinafter specified. The normal power shall be transformed, rectified, coordinated, and interfaced with the standby battery and charger.

The door holder power shall be arranged so that momentary or sustained loss of main operating power shall not cause the release of any door.

Power supply for smoke detectors shall be taken from the fire alarm control unit.

Provide protectors to protect the fire alarm equipment from damage due to lightning or voltage and current transients.

Provide new separate and direct ground lines to the outside to protect the equipment from unwanted grounds.

- D. Circuit Supervision: Each alarm initiating device circuit, signaling line circuit, and notification appliance circuit, shall be supervised against the occurrence of a break or ground fault condition in the field wiring. These conditions shall cause a trouble signal to sound in the control unit until manually silenced by a trouble silence switch.
- E. Supervisory Devices: All sprinkler system valves, standpipe control valves, post indicator valves (PIV), and main gate valves shall be supervised for off-normal position. Closing a valve shall sound a supervisory signal at the control unit until silenced by an off switch. The specific location of all closed valves shall be identified at the control unit. Valve operation shall not cause an alarm signal. Duct detectors shall be monitored as supervisory signals. The power supply to the elevator shunt trip breaker shall be monitored by the fire alarm system as a supervisory signal.
- F. Trouble signals:
Arrange the trouble signals for automatic reset (non-latching). System trouble switch off and on lamps shall be visible through the control unit door.
- G. Function Switches: Provide the following switches in addition to any other switches required for the system:
- Remote Alarm Transmission By-pass Switch: Shall prevent transmission of all signals to the site central annunciation system when in the "off" position. A system trouble signal shall be energized when switch is in the off position.
- Alarm Off Switch: Shall disconnect power to alarm notification circuits on the building alarm system. A system trouble signal shall be activated when switch is in the off position.
- Trouble Silence Switch: Shall silence the trouble signal whenever the trouble silence switch is operated. This switch shall not reset the trouble signal.
- Reset Switch: Shall reset the system after an alarm, provided the initiating device has been reset. The system shall lock in alarm until reset.
- Lamp Test Switch: A test switch or other approved convenient means shall be provided to test the indicator lamps.
- Door Holder By-Pass Switch: Shall prevent doors from releasing during fire alarm tests. A system trouble alarm shall be energized when switch is in the abnormal position.
- Elevator recall By-Pass Switch: Shall prevent the elevators from recalling upon operation of any of the devices installed to perform

that function. A system trouble alarm shall be energized when the switch is in the abnormal position.

8. HVAC/Smoke Damper By-Pass: Provide a means to disable HVAC fans from shutting down and/or smoke dampers from closing upon operation of an initiating device designed to interconnect with these devices.

H. Remote Transmissions:

Provide capability and equipment for transmission of alarm, supervisory and trouble signals to the site central annunciation system.

Transmitters shall be compatible with the systems and equipment they are connected to such as timing, operation and other required features.

- I. Remote Control Capability: Each building fire alarm control unit shall be installed and programmed so that each must be reset locally after an alarm, before the main fire alarm control unit can be reset. After the local building fire alarm control unit has been reset, then the all system acknowledge, reset, silence or disabling functions can be operated by the main fire alarm control unit

- J. System Expansion: Design the control units and enclosures so that the system can be expanded in the future (to include the addition of fifty percent more alarm initiating, alarm notification and door holder circuits) without disruption or replacement of the existing control unit and secondary power supply.

2.4 STANDBY POWER SUPPLY

A. Uninterrupted Power Supply (UPS):

Batteries shall be sealed, gel cell type.

UPS system shall be sized to operate the central processor, CRT, printer, and all other directly connected equipment for five minutes upon a normal AC power failure.

B. Batteries:

Battery shall be of the sealed, maintenance free type, 24-volt nominal.

Battery shall have sufficient capacity to power the fire alarm system for not less than four hours plus five minutes of alarm to an end voltage of 1.14 volts per cell, upon a normal AC power failure.

System load shall include the power required by the electromagnetic door holders.

Battery racks shall be steel with an alkali-resistant finish. Batteries shall be secured in seismic areas 2B, 3, or 4 as defined by the Uniform Building Code.

C. Battery Charger:

Shall be completely automatic, with constant potential charger maintaining the battery fully charged under all service conditions. Charger shall operate from a 120-volt, 60 hertz emergency power source.

Shall be rated for fully charging a completely discharged battery within 48 hours while simultaneously supplying any loads connected to the battery.

Shall have protection to prevent discharge through the charger.

Shall have protection for overloads and short circuits on both AC and DC sides.

A trouble condition shall actuate the fire alarm trouble signal.

Charger shall have automatic AC line voltage regulation, automatic current-limiting features, and adjustable voltage controls.

2.5 ANNUNCIATION

A. Annunciator, Alphanumeric Type (System):

Shall be a supervised, LCD display containing a minimum of two lines of 40 characters for alarm annunciation in clear English text.

Message shall identify building number, floor, zone, etc on the first line and device description and status (pull station, smoke detector, waterflow alarm or trouble condition) on the second line.

The initial alarm received shall be indicated as such.

A selector switch shall be provided for viewing subsequent alarm messages.

The display shall be UL listed for fire alarm application.

B. Printers:

System printers shall be high reliability digital input devices, UL approved, for fire alarm applications. The printers shall operate at a minimum speed of 30 characters per second. The printer shall be continually supervised.

Printers shall be programmable to either alarm only or event logging output.

Alarm printers shall provide a permanent (printed) record of all alarm information that occurs within the fire alarm system.

Alarm information shall include the date, time, building number, floor, zone, device type, device address, and condition.

Event logging printers shall provide a permanent (printed) record of every change of status that occurs within the fire alarm system.

Status information shall include date, time, building number, floor, zone, device type, device address and change of status (alarm, trouble, supervisory, reset/return to normal).

09-05M

feed pins for conventional fan fold 213 mm x 275 mm (8-1/2" x 11") paper.

The printers shall provide a printing and non-printing self test feature.

Power supply for printers shall be taken from and coordinated with the building emergency service.

Each printer shall be provided with a stand for the printer and paper.

Spare paper and ribbons for printers shall be stocked and maintained as part of the five (5) year guarantee period services in addition to the one installed after the approval of the final acceptance test.

2.7 ALARM NOTIFICATION APPLIANCES

A. Bells:

Shall be electric, single-stroke or vibrating, heavy-duty, under-dome, solenoid type.

Unless otherwise shown on the drawings, shall be 150 mm (6 inches) diameter and have a minimum nominal rating of 80 dBA at 3000 mm (10 feet).

Mount on removable adapter plates on outlet boxes.

Bells located outdoors shall be weatherproof type with metal housing and protective grille.

Each bell circuit shall have a minimum of twenty percent spare capacity.

B. Speakers:

Shall operate on either 25 VRMS or 70.7 VRMS with field selectable output taps from 0.5 to 2.0W and originally installed at the one-half watt tap. Speakers shall provide a minimum sound output of 80 dBA at ten feet with the one-half watt tap.

Frequency response shall be a minimum of 400 HZ to 4000 HZ.

100 mm (4 inches) or 200 mm (8 inches) cone type speakers ceiling mounted with white colored baffles in areas with suspended ceilings and wall mounted in areas without ceilings.

C. Strobes:

Xenon flash tube type minimum 15 candela in toilet rooms and 75 candela in all other areas with a flash rate of 1 HZ. Strobes shall be synchronized where required by the National Fire Alarm Code (NFPA 72).

Backplate shall be red with 13 mm (1/2 inch) permanent red letters.

Lettering to read "Fire", be oriented on the wall or ceiling properly, and be visible from all viewing directions.

Each strobe circuit shall have a minimum of twenty (20) percent spare capacity.

Strobes may be combined with the audible notification appliances specified herein.

D. Fire Alarm Horns:

Shall be electric, utilizing solid state electronic technology operating on a nominal 24 VDC.

Shall be a minimum nominal rating of 80 dBA at ten feet.

Mount on removable adapter plates on conduit boxes.

Horns located outdoors shall be of weatherproof type with metal housing and protective grille.

Each horn circuit shall have a minimum of twenty (20) percent spare capacity.

2.8 ALARM INITIATING DEVICES

A. Manual Fire Alarm Stations:

Shall be non-breakglass, address reporting type.

Station front shall be constructed of a durable material such as cast or extruded metal or high impact plastic. Stations shall be semi-flush type.

Stations shall be of single action pull down type with suitable operating instructions provided on front in raised or depressed letters, and clearly labeled "FIRE".

Operating handles shall be constructed of a durable material. On operation, the lever shall lock in alarm position and remain so until reset. A key shall be required to gain front access for resetting, or conducting tests and drills.

Unless otherwise specified, all exposed parts shall be red in color and have a smooth, hard, durable finish.

B. Smoke Detectors:

Smoke detectors shall be UL listed for use with the fire alarm control unit being furnished.

Smoke detectors shall be addressable type complying with applicable UL Standards for system type detectors. Smoke detectors shall be installed in accordance with the manufacturer's recommendations and NFPA 72.

Detectors shall have an indication lamp to denote an alarm condition.

Provide remote indicator lamps and identification plates where detectors are concealed from view. Locate the remote indicator lamps and identification plates flush mounted on walls so they can be observed from a normal standing position.

All spot type and duct type detectors installed shall be of the photoelectric type.

Photoelectric detectors shall be factory calibrated and readily field adjustable. The sensitivity of any photoelectric detector shall be factory set at 3.0 plus or minus 0.25 percent obscuration per foot. Detectors shall provide a visual trouble indication if they drift out of sensitivity range or fail internal diagnostics. Detectors shall also provide visual indication of sensitivity level upon testing. Detectors, along with the fire alarm control units shall be UL listed for testing the sensitivity of the detectors.

C. Heat Detectors:

Heat detectors shall be of the addressable restorable rate compensated fixed-temperature spot type.

Detectors shall have a minimum smooth ceiling rating of 2500 square feet.

Ordinary temperature (135 degrees F) heat detectors shall be utilized in elevator shafts and elevator mechanical rooms. Intermediate temperature rated (200 degrees F) heat detectors shall be utilized in all other areas.

Provide a remote indicator lamp, key test station and identification nameplate (e.g. "Heat Detector - Elevator P-_____) for each elevator group. Locate key test station in plain view on elevator machine room wall.

D. Water Flow and Pressure Switches:

Wet pipe water flow switches and dry pipe alarm pressure switches for sprinkler systems shall be connected to the fire alarm system by way of an address reporting interface device.

All new water flow switches shall be of a single manufacturer and series and non-accumulative retard type. See Section 21 12 00, FIRE-SUPPRESSION STANDPIPES and Section 21 13 13, WET-PIPE SPRINKLER SYSTEMS for new switches added. Connect all switches shown on the approved shop drawings.

All new switches shall have an alarm transmission delay time that is conveniently adjustable from 0 to 60 seconds. Initial settings shall be 30-45 seconds. Timing shall be recorded and documented during testing.

E. Extinguishing System Connections:

1. Kitchen Range Hood and Duct Suppression Systems:

- a. Each suppression system shall be equipped with a micro-switch connected to the building fire alarm control unit. Discharge of a

suppression system shall automatically send a alarm signal to the building fire detection and alarm system for annunciation.

- b. Operation of this suppression system shall also automatically shut off all sources of fuel and heat to all equipment requiring protection under the same hood.

2. Each gaseous suppression system shall be monitored for system alarm and system trouble conditions via addressable interface devices. 2.9

SUPERVISORY DEVICES

A. In-Duct Smoke Detectors:

Duct smoke detectors shall be provided and connected under this section. Detectors shall be listed and labeled for in-duct installation. Detectors shall be provided with an approved duct housing mounted exterior to the duct, and shall have perforated sampling tubes extending across the full width of the duct (wall to wall). Detector placement shall be such that there is uniform airflow in the cross section of the duct.

Interlocking with fans shall be provided in accordance with NFPA 90A and as specified hereinafter under Part 3.2, "TYPICAL OPERATION".

Provide remote indicator lamps, key test stations and identification nameplates (e.g. "DUCT SMOKE DETECTOR AHU-X") for all duct detectors. Locate key test stations in plain view on walls or ceilings so that they can be observed and operated from a normal standing position.

B. Sprinkler and Standpipe System Supervisory Switches:

Each sprinkler system water supply control valve, riser valve or zone control valve, and each standpipe system riser control valve shall be equipped with a supervisory switch. Standpipe hose valves, and test and drain valves shall not be equipped with supervisory switches. PIV (post indicator valve) or main gate valve shall be equipped with a supervisory switch.

Valve supervisory switches shall be connected to the fire alarm system by way of address reporting interface device. See Section 21 13 13, WET-PIPE SPRINKLER SYSTEMS for new switches to be added. Connect tamper switches for all control valves shown on the approved shop drawings.

The mechanism shall be contained in a weatherproof die-cast aluminum housing that shall provide a 19 mm (3/4 inch) tapped conduit entrance and incorporate the necessary facilities for attachment to the valves.

The entire installed assembly shall be tamper-proof and arranged to cause a switch operation if the housing cover is removed or if the unit is removed from its mounting.

2.10 ADDRESS REPORTING INTERFACE DEVICE

Shall have unique addresses that reports directly to the building fire alarm panel.

Shall be configurable to monitor normally open or normally closed devices for both alarm and trouble conditions.

Shall have terminal designations clearly differentiating between the circuit to which they are reporting from and the device that they are monitoring.

Shall be UL listed for fire alarm use and compatibility with the panel to which they are connected.

Shall be mounted in weatherproof housings if mounted exterior to a building.

2.11 SMOKE BARRIER DOOR CONTROL

A. Electromagnetic Door Holders:

New Door Holders shall be standard wall mounted electromagnetic type.

In locations where doors do not come in contact with the wall when in the full open position, an extension post shall be added to the door bracket.

Operation shall be by 24 volt DC supplied from a battery located at the fire alarm control unit. Door holders shall be coordinated as to voltage, ampere drain, and voltage drop with the battery, battery charger, wiring and fire alarm system for operation as specified.

B. A maximum of twelve door holders shall be provided for each circuit.

Door holders shall be wired to allow releasing doors by smoke zone.

C. Door holder control circuits shall be electrically supervised.

D. Smoke detectors shall not be incorporated as an integral part of door holders.

2.12 UTILITY LOCKS AND KEYS:

All key operated test switches, control units, annunciator panels and lockable cabinets shall be provided with a single standardized utility lock and key.

All keys shall be delivered to the COTR.

2.13 SPARE AND REPLACEMENT PARTS

A. Provide spare and replacement parts as follows:

Manual pull stations - 1

Heat detectors - 1 of each type

Fire alarm strobes - 5

Smoke detectors - 20

In-duct smoke detectors with all appurtenances - 1

Sprinkler system water flow switch - 1 of each size

Sprinkler system water pressure switch - 1 of each type
 Sprinkler valve tamper switch - 1 of each type
 Control equipment keys - 5
 2.5 oz containers aerosol smoke - 2
 Fire alarm SLC cable (same as installed) - 152 m (500 feet)
 Spare and replacement parts shall be in original packaging and submitted to the COTR.

Furnish and install a storage cabinet of sufficient size and suitable for storing spare equipment. Doors shall include a pad locking device. Padlock to be provided by the VA. Location of cabinet to be determined by the COTR.

Provide to the VA, all hardware, software, programming tools, license and documentation necessary to permanently modify the fire alarm system on site. The minimum level of modification includes addition and deletion of devices, circuits, zones and changes to system description, system operation, and digitized evacuation and instructional messages. **2.14 INSTRUCTION CHART:**

Provide a typeset printed or typewritten instruction card mounted behind a Lexan plastic or glass cover in a stainless steel or aluminum frame with a backplate. Install the frame in a conspicuous location observable from each control unit where operations are performed. The card shall show those steps to be taken by an operator when a signal is received under all conditions, normal, alarm, supervisory, and trouble. Provide an additional copy with the binder for the input output matrix for the sequence of operation. The instructions shall be approved by the COTR before being posted.

PART 3 - EXECUTION

3.1 INSTALLATION:

Installation shall be in accordance with NFPA 70, 72, 90A, and 101 as shown on the drawings, and as recommended by the major equipment manufacturer. Fire alarm wiring shall be installed in conduit. All conduit and wire shall be installed in accordance with Section 26 05 33, RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS , Section 26 05 21, LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES (600 VOLTS AND BELOW), and all penetrations of smoke and fire barriers shall be protected as required by Section 07 84 00, FIRESTOPPING.

All new conduits, junction boxes, conduit supports and hangers shall be concealed in finished areas and may be exposed in unfinished areas.

All exposed conduit shall be painted in accordance with Section 09 91 00, PAINTING to match surrounding finished areas and red in unfinished areas.

All fire detection and alarm system devices, control units and remote annunciators shall be flush mounted when located in finished areas and may be surface mounted when located in unfinished areas. Exact locations to be approved by the COTR.

Speakers shall be ceiling mounted and fully recessed in areas with suspended ceilings. Speakers shall be wall mounted and recessed in finished areas without suspended ceilings. Speakers may be surface mounted in unfinished areas.

Strobes shall be flush wall mounted 2,000 mm (80 inches) above the floor or 150 mm (6 inches) below ceiling, whichever is lower. Locate and mount to maintain a minimum 900 mm (36 inches) clearance from side obstructions.

Manual pull stations shall be installed not less than 1050 mm (42 inches) or more than 1200 mm (48 inches) from finished floor to bottom of device and within 1500 mm (60 inches) of a stairway or an exit door.

Where possible, locate water flow and pressure switches a minimum of 300 mm (12 inches) from a fitting that changes the direction of the flow and a minimum of 900 mm (36 inches) from a valve.

Smoke detectors shall be installed within five feet of smoke barrier doors and a minimum of three feet from HVAC system grills.

Mount valve tamper switches so as not to interfere with the normal operation of the valve and adjust to operate within two revolutions toward the closed position of the valve control, or when the stem has moved no more than one-fifth of the distance from its normal position.

Connect flow and tamper switches installed under Section 21 13 13, WET-PIPE SPRINKLER SYSTEMS.

Connect combination closer-holders installed under Section 08 71 00, DOOR HARDWARE. **3.2 TYPICAL OPERATION**

A. Activation of any manual pull station, water flow or pressure switch, heat detector, or smoke detector shall cause the following operations to occur:

Continuously sound a temporal pattern general alarm and flash all strobes in the building in alarm until reset at the local fire alarm control unit in Building.

Release only the magnetic door holders on the floor from which alarm was initiated after the alert signal.

Transmit a separate alarm signal, via the site central annunciation system to the remote location.

B. Heat detectors in elevator machine rooms shall, in addition to the above functions, disconnect all power to all elevators served by that machine

room after a time delay. The time delay shall be programmed within the fire alarm system programming and be equal to the time it takes for the car to travel from the highest to the lowest level, plus 10 seconds. Smoke detectors in the primary elevator lobbies and elevator machine room of Buildings shall, in addition to the above functions, return all elevators in the bank to the secondary floor.

Smoke detectors in the remaining elevator lobbies, or top of hoistway shall, in addition to the above functions, return all elevators in the bank to the primary floor.

Operation of a smoke detector at a corridor door used for automatic closing shall also release only the magnetic door holders on that floor.

Operation of duct smoke detectors shall cause a system supervisory condition and shut down the ventilation system and close the associated smoke dampers as appropriate.

Operation of any sprinkler or standpipe system valve supervisory switch, high/low air pressure switch, or fire pump alarm switch shall cause a system supervisory condition.

3.3 TESTS

Provide the service of a NICET level III, competent, factory-trained engineer or technician authorized by the manufacturer of the fire alarm equipment to technically supervise and participate during all of the adjustments and tests for the system. Make all adjustments and tests in the presence of the COTR.

When the systems have been completed and prior to the scheduling of the final inspection, furnish testing equipment and perform the following tests in the presence of the COTR. When any defects are detected, make repairs or install replacement components, and repeat the tests until such time that the complete fire alarm systems meets all contract requirements. After the system has passed the initial test and been approved by the COTR, the contractor may request a final inspection. Before energizing the cables and wires, check for correct connections and test for short circuits, ground faults, continuity, and insulation.

Test the insulation on all installed cable and wiring by standard methods as recommended by the equipment manufacturer.

Run water through all flow switches. Check time delay on water flow switches. Submit a report listing all water flow switch operations and their retard time in seconds.

Open each alarm initiating and notification circuit to see if trouble signal actuates.

Ground each alarm initiation and notification circuit and verify response of trouble signals.

Check alarm transmission to all fire alarm notification.

3.4 FINAL INSPECTION AND ACCEPTANCE

Prior to final acceptance a minimum 30 day "burn-in" period shall be provided. The purpose shall be to allow equipment to stabilize and potential installation and software problems and equipment malfunctions to be identified and corrected. During this diagnostic period, all system operations and malfunctions shall be recorded. Final acceptance will be made upon successful completion of the "burn-in" period and where the last 14 days is without a system or equipment malfunction.

At the final inspection a factory trained representative of the manufacturer of the major equipment shall repeat the tests in Article 3.3 TESTS and those required by NFPA 72. In addition the representative shall demonstrate that the systems function properly in every respect. The demonstration shall be made in the presence of a VA representative.

3.5 INSTRUCTION

- A. The manufacturer's authorized representative shall provide instruction and training to the VA as follows:

Six one-hour sessions to engineering staff, security police and central attendant personnel for simple operation of the system. Two sessions at the start of installation, two sessions at the completion of installation and two sessions 3 months after the completion of installation.

Four two-hour sessions to engineering staff for detailed operation of the system. Two sessions at the completion of installation, and two sessions 3 months after the completion of installation

Three eight-hour sessions to electrical technicians for maintaining, programming, modifying, and repairing the system at the completion of installation and one eight-hour refresher session 3 months after the completion of installation.

- B. The Contractor and/or the Systems Manufacturer's representative shall provide a typewritten "Sequence of Operation" including a trouble shooting guide of the entire system for submittal to the VA. The sequence of operation will be shown for each input in the system in a matrix format and provided in a loose leaf binder. When reading the sequence of operation, the reader will be able to quickly and easily determine what output will occur upon activation of any input in the system. The INPUT/OUTPUT matrix format shall be as shown in Appendix A to NFPA 72.

C. Furnish the services of a competent instructor for instructing personnel in the programming requirements necessary for system expansion. Such programming shall include addition or deletion of devices, zones, indicating circuits and printer/display text.

- - - END - - -

SECTION 31 20 11
EARTH MOVING (SHORT FORM)

PART 1 - GENERAL

1.1 DESCRIPTION:

This section specifies the requirements for furnishing all equipment, materials, labor and techniques for earthwork including excavation, fill, backfill and site restoration utilizing fertilizer, seed and/or sod.

1.2 DEFINITIONS:

A. Unsuitable Materials:

Fills: Topsoil, frozen materials; construction materials and materials subject to decomposition; clods of clay and stones larger than 75 mm (3 inches); organic materials, including silts, which are unstable; and inorganic materials, including silts, too wet to be stable.

Existing Subgrade (except footings): Same materials as above paragraph, that are not capable of direct support of slabs, pavement, and similar items, with the possible exception of improvement by compaction, proofrolling, or similar methods of improvement.

Existing Subgrade (footings only): Same as Paragraph 1, but no fill or backfill. If materials differ from reference borings and design requirements, excavate to acceptable strata subject to COTR's approval.

B. Earthwork: Earthwork operations required within the new construction area. It also includes earthwork required for auxiliary structures and buildings and sewer and other trenchwork throughout the job site.

C. Degree of Compaction: Degree of compaction is expressed as a percentage of maximum density obtained by the test procedure presented in ASTM // D698.

D. The term fill means fill or backfill as appropriate.

1.3 RELATED WORK:

Materials testing and inspection during construction: Section 01 45 29, TESTING LABORATORY SERVICES.

Safety Requirements : Section 00 72 00, GENERAL CONDITIONS, Article, ACCIDENT PREVENTION.

Protection of existing utilities, fire protection services, existing equipment, roads, and pavements: Section 01 00 00, GENERAL REQUIREMENTS.

Subsurface Investigation: Section 01 00 00, GENERAL REQUIREMENTS, Article, PHYSICAL DATA.

1.4 CLASSIFICATION OF EXCAVATION:

A. Unclassified Excavation: Removal and disposal of pavements and other man-made obstructions visible on the surface; utilities, and other items including underground structures indicated to be demolished and removed; together with any type of materials regardless of character of material and obstructions encountered.

1.5 SUBMITTALS:

A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

1.6 APPLICABLE PUBLICATIONS:

Publications listed below form a part of this specification to the extent referenced. Publications are referenced in the text by the basic designation only.

American Nursery and Landscape Association (ANLA):

2004 American Standard for Nursery Stock

American Association of State Highway and Transportation Officials (AASHTO):

T99-01 (R2004) Moisture-Density Relations of Soils Using a 2.5 kg (5.5 lb) Rammer and a 305 mm (12 inch) Drop

T180-01 (2004) Moisture-Density Relations of Soils Using a 4.54-kg [10 lb] Rammer and a 457 mm (18 inch) Drop

American Society for Testing and Materials (ASTM):

D698-07 Laboratory Compaction Characteristics of Soil Using Standard Effort

D1557-02 Laboratory Compaction Characteristics of Soil Using Modified Effort

Idaho Standards for Public Works Construction, latest revision.

PART 2 - PRODUCTS

2.1 MATERIALS:

Fills: Materials approved from on site and off site sources having a minimum dry density of 1760 kg/m³ (110 pcf), a maximum Plasticity Index of 6, and a maximum Liquid Limit of 30.

Granular Fill:

1. Under concrete slab, crushed stone or gravel graded from 19 mm (3/4 inch) to 4.75 mm (No. 4).

Fertilizer: (5-10-5) delivered to site in unopened containers that clearly display the manufacturer's label, indicating the analysis of the contents.

Seed: Grass mixture comparable to existing turf delivered to site in unopened containers that clearly display the manufacturer's label, indicating the analysis of the contents.

Sod: Comparable species with existing turf. Use State Certified or State Approved sod when available. Deliver sod to site immediately after cutting and in a moist condition. Thickness of cut must be 19 mm to 32 mm (3/4 inch to 1 1/4 inches) excluding top growth. There shall be no broken pads and torn or uneven ends.

2.2 WARNING TAPE

A. Standard, 4-Mil polyethylene 76 mm (3 inch) wide tape, detectable type, color coded to the utility, and imprinted with "CAUTION BURIED (Utility) LINE BELOW".

PART 3 - EXECUTION

3.1 SITE PREPARATION:

Clearing: Clearing within the limits of earthwork operations as described or designated by the COTR. Work includes removal of trees, shrubs, fences, foundations, incidental structures, paving, debris, trash and any other obstructions. Remove materials from the // Medical Center.

Grubbing: Remove stumps and roots 75 mm (3 inches) and larger diameter. Undisturbed sound stumps, roots up to 75 mm (3 inches) diameter, and nonperishable solid objects which will be a minimum of 900 mm (3 feet) below subgrade or finished embankment may be left.

Trees and Shrubs: Trees and shrubs, not shown for removal, may be removed from the areas within 4500 mm (15 feet) of new construction and 2250 mm (7'-6") of utility lines if such removal is approved in advance by the COTR. Remove materials from the Medical Center. Maintain trees and shrubs held in temporary locations by watering as necessary and feeding semi-annually with liquid fertilizer with a minimum analysis of 5 percent nitrogen, 10 percent phosphorus and 5 percent potash. Maintain plants moved to permanent positions as specified for plants in temporary locations until the conclusion of the contract. Box, and otherwise protect from damage, existing trees and shrubs which are not shown to be removed in the construction area. Repair immediately damage to existing trees and shrubs by trimming, cleaning and painting damaged areas,

including the roots, in accordance with standard industry horticultural practice for the geographic area and plant species. Building materials shall not be stored closer to trees and shrubs, that are to remain, than the farthest extension of their limbs.

Stripping Topsoil: Unless otherwise indicated on the drawings, the limits of earthwork operations shall extend anywhere the existing grade is filled or cut or where construction operations have compacted or otherwise disturbed the existing grade or turf. Strip topsoil as defined herein, or as indicated in the geotechnical report, from within the limits of earthwork operations as specified above unless specifically indicated or specified elsewhere in the specifications or shown on the drawings. Topsoil shall be fertile, friable, natural topsoil of loamy character and characteristic of the locality. Topsoil shall be capable of growing healthy horticultural crops of grasses. Stockpile topsoil and protect as directed by the COTR. Eliminate foreign material, such as weeds, roots, stones, subsoil, frozen clods, and similar foreign materials, larger than 0.014 m³ (1/2 cubic foot) in volume, from soil as it is stockpiled. Retain topsoil on the station. Remove foreign materials larger than 50 mm (2 inches) in any dimension from topsoil used in final grading. Topsoil work, such as stripping, stockpiling, and similar topsoil work, shall not, under any circumstances, be carried out when the soil is wet so that the tilth of the soil will be destroyed. 1. Concrete Slabs and Paving: Score deeply or saw cut to insure a neat,

straight cut, sections of existing concrete slabs and paving to be removed where excavation or trenching occurs. Extend pavement section to be removed a minimum of 300 mm (12 inches) on each side of widest part of trench excavation and insure final score lines are approximately parallel unless otherwise indicated. Remove material from the Medical Center.

Disposal: All materials removed from the property shall be disposed of at a legally approved site, for the specific materials, and all removals shall be in accordance with all applicable Federal, State and local regulations. No burning of materials is permitted onsite.

3.2 EXCAVATION:

A. Shoring, Sheet piling and Bracing: Shore, brace, or slope to its angle of repose banks of excavations to protect workmen, banks, adjacent paving, structures, and utilities, in compliance with OSHA requirements.

Extend shoring and bracing to the bottom of the excavation. Shore excavations that are carried below the elevations of adjacent existing foundations.

If the bearing of any foundation is disturbed by excavating, improper shoring or removal of shoring, placing of backfill, and similar operations, provide a concrete fill support in compliance with Idaho Standards for Public Works Construction (ISPWC) - current edition, Division 703, under disturbed foundations, as directed by COTR, at no additional cost to the Government. Do not remove shoring until permanent work in excavation has been inspected and approved by COTR.

B. Excavation Drainage: Operate pumping equipment and/or provide other materials, means and equipment as required, to keep excavations free of water and subgrades dry, firm, and undisturbed until approval of permanent work has been received from COTR. Approval by the COTR is also required before placement of the permanent work on all subgrades. When subgrade for foundations has been disturbed by water, remove the disturbed material to firm undisturbed material after the water is brought under control. Replace disturbed subgrade in trenches by mechanically tamped sand or gravel. When removed disturbed material is located where it is not possible to install and properly compact disturbed subgrade material with mechanically compacted sand or gravel, the COTR should be contacted to consider the use of flowable fill.

C. Blasting: Blasting shall not be permitted.

D. Trench Earthwork:

1. Utility trenches (except sanitary and storm sewer):

Excavate to a width as necessary for sheeting and bracing and proper performance of the work.

Grade bottom of trenches with bell-holes, scooped-out to provide a uniform bearing.

Support piping on undisturbed earth unless a mechanical support is shown.

The length of open trench in advance of pipe laying shall not be greater than is authorized by the COTR.

All utilities shall have a warning tape located 12" [0.31M] below finished grade centered over the utility.

E. Site Earthwork: Excavation shall be accomplished as required by drawings and specifications. Remove subgrade materials, that are determined by the Geotechnical Engineer as unsuitable, and replace with acceptable material. When unsuitable material is encountered and removed, the contract price and time will be adjusted in accordance with Articles,

DIFFERING SITE CONDITIONS, CHANGES and CHANGES-SUPPLEMENT of the GENERAL CONDITIONS as applicable. Adjustments to be based on meters (yardage) in cut section only.

F. Finished elevation of subgrade shall be as follows:

Pavement Areas - bottom of the pavement or base course as applicable.

Planting and Lawn Areas - 100 mm (4 inches) below the finished grade, unless otherwise specified or indicated on the drawings.

3.3 FILLING AND BACKFILLING:

General: Do not fill or backfill until all debris, unsatisfactory soil materials, obstructions, and deleterious materials have been removed from the excavation. Proof-roll exposed subgrades with a fully loaded dump truck. Use excavated materials or borrow for fill and backfill, as applicable. Do not use unsuitable excavated materials. Do not backfill until foundation walls have been completed above grade and adequately braced, waterproofing or dampproofing applied, and pipes coming in contact with backfill have been installed, and inspected and approved by COTR.

Proof-rolling Existing Subgrade: Proof-roll with a fully loaded dump truck. Make a minimum of one pass in each direction. Remove unstable uncompactable material and replace with granular fill material completed to mix requirements specified.

Placing: Place material in horizontal layers not exceeding 200 mm (8 inches) in loose depth and then compacted. Do not place material on surfaces that are muddy, frozen, or contain frost.

Compaction: Use approved equipment (hand or mechanical) well suited to the type of material being compacted. Do not operate mechanized vibratory compaction equipment within 3000 mm (10 feet) of new or existing building walls without the prior approval of the COTR. Moisten or aerate material as necessary to provide the moisture content that will readily facilitate obtaining the specified compaction with the equipment used. Compact each layer to not less than 95 percent of the maximum density determined in accordance with test method ASTM D698.

3.4 GRADING:

A. General: Uniformly grade the areas within the limits of this section, including adjacent transition areas. Smooth the finished surface within specified tolerance. Provide uniform levels or slopes between points where elevations are indicated, or between such points and existing finished grades. Provide a smooth transition between abrupt changes in slope.

Cut rough or sloping rock to level beds for foundations. In unfinished areas fill low spots and level off with coarse sand or fine gravel.

Place crushed stone or gravel fill under concrete slabs on grade tamped and leveled. The thickness of the fill shall be 150 mm (6 inches), unless otherwise indicated.

Finish subgrade in a condition acceptable to the COTR at least one day in advance of the paving operations. Maintain finished subgrade in a smooth and compacted condition until the succeeding operation has been accomplished. Scarify, compact, and grade the subgrade prior to further construction when approved compacted subgrade is disturbed by contractor's subsequent operations or adverse weather.

Grading for Paved Areas: Provide final grades for both subgrade and base course to +/- 6 mm (0.25 inches) of indicated grades.

3.5 LAWN AREAS:

General: Harrow and till to a depth of 100 mm (4 inches), new or existing lawn areas to remain, which are disturbed during construction. Establish existing or design grades by dragging or similar operations. Do not carry out lawn areas earthwork out when the soil is wet so that the tilth of the soil will be destroyed. Plant bed must be approved by COTR before seeding or sodding operation begins.

Finished Grading: Begin finish grading after rough grading has had sufficient time for settlement. Scarify subgrade surface in lawn areas to a depth of 100 mm (4 inches). Apply topsoil so that after normal compaction, dragging and raking operations (to bring surface to indicated finish grades) there will be a minimum of 100 mm (4 inches) of topsoil over all lawn areas; make smooth, even surface and true grades, which will not allow water to stand at any point. Shape top and bottom of banks to form reverse curves in section; make junctions with undisturbed areas to conform to existing topography. Solid lines within grading limits indicate finished contours. Existing contours, indicated by broken lines are believed approximately correct but are not guaranteed.

Fertilizing: Incorporate fertilizer into the soil to a depth of 100 mm (4 inches) at a rate of 12 kg/100 m² (25 pounds per 1000 square feet).

Seeding: Seed at a rate of 2 kg/100 m² (4 pounds per 1000 square feet) and accomplished only during periods when uniform distribution may be assured. Lightly rake seed into bed immediately after seeding. Roll seeded area immediately with a roller not to exceed 225 kg/m (150 pounds per foot) of roller width.

Sodding: Topsoil shall be firmed by rolling and during periods of high temperature the topsoil shall be watered lightly immediately prior to laying sod. Sod strips shall be tightly butted at the ends and staggered in a running bond fashion. Placement on slopes shall be from the bottom to top of slope with sod strips running across slope. Secure sodded slopes by pegging or other approved methods. Roll sodded area with a roller not to exceed 225 kg/m (150 pounds per foot) of the roller width to improve contact of sod with the soil.

Watering: The COTR is responsible for having adequate water available at the site. As sodding is completed in any one section, the entire sodded area shall be thoroughly irrigated by the contractor, to a sufficient depth, that the underside of the new sod pad and soil, immediately below sod, is thoroughly wet. COTR will be responsible for sod after installation and acceptance.

3.6 DISPOSAL OF UNSUITABLE AND EXCESS EXCAVATED MATERIAL:

Disposal: Remove surplus satisfactory soil and waste material, including unsatisfactory soil, trash, and debris, and legally dispose of it off Medical Center property.

1. Remove waste material, including unsatisfactory soil, trash, and debris, and legally dispose of it off Medical Center property.

Place excess excavated materials suitable for fill and/or backfill on site where directed by COTR.

Remove from site and dispose of any excess excavated materials after all fill and backfill operations have been completed.

Segregate all excavated contaminated soil designated by the COTR from all other excavated soils, and stockpile on site on two 0.15 mm (6 mil) polyethylene sheets with a polyethylene cover. A designated area shall be selected for this purpose. Dispose of excavated contaminated material in accordance with State and Local requirements.

3.6 CLEAN-UP:

Upon completion of earthwork operations, clean areas within contract limits, remove tools, and equipment. Provide site clear, clean, free of debris, and suitable for subsequent construction operations. Remove debris, rubbish, and excess material from the Medical Center Property.

- - - E N D - - -

**SECTION 31 23 19
DEWATERING**

PART 1 - GENERAL

1.1 DESCRIPTION:

This section specifies performance of dewatering required to lower and control ground water table levels and hydrostatic pressures to permit excavation, backfill, and construction to be performed in the dry. Control of surface water shall be considered as part of the work under this specification.

The geotechnical report for this site indicates ground water was not encountered down to 21.5 ft. [8.55m] below ground surface. The portions of this section applying to ground water dewatering are not a part of this contract, surface water is a part of this contract.

If ground water becomes an issue at the time of construction it will be addressed under changed conditions. The following specifications regarding ground water dewatering will then become part of the contract.

1.2 SUMMARY:

- A. The work to be completed by the Contractor includes, but is not necessarily limited to the following:
- Implementation of the Erosion and Sedimentation Control Plan.
 - Dewater excavations, including seepage and precipitation.
- B. The Contractor shall be responsible for providing all materials, equipment, labor, and services necessary for care of water and erosion control. Excavation work shall not begin before the Erosion and Sedimentation Control Plan is in place.

1.3 REQUIREMENT:

Dewatering system shall be of sufficient size and capacity necessary to lower and maintain surface water to an elevation at least 300 mm (1 foot) below lowest foundation subgrade or bottom of pipe trench and to allow material to be excavated in a reasonably dry condition. Materials to be removed shall be sufficiently dry to permit excavation to grades shown and to stabilize excavation slopes where sheeting is not required. Operate dewatering system continuously until backfill work has been completed.

Reduce hydrostatic head below any excavation to the extent that water level in the construction area is a minimum of 300 mm (1 foot) below prevailing excavation surface.

C. Prevent loss of fines, seepage, boils, quick conditions or softening of foundation strata.

D. Maintain stability of sides and bottom of excavation.

E. Construction operations are performed in the dry.

F. Control of surface and subsurface water is part of dewatering requirements. Maintain adequate control so that:

The stability of excavated and constructed slopes are not adversely affected by saturated soil, including water entering prepared subbase and subgrades where underlying materials are not free draining or are subject to swelling or freeze-thaw action.

Erosion is controlled.

Flooding of excavations or damage to structures does not occur.

Surface water drains away from excavations.

Excavations are protected from becoming wet from surface water, or insure excavations are dry before additional work is undertaken.

G. Permitting Requirements: The contractor shall comply with and obtain the required State and County permits where the work is performed.

1.4 RELATED WORK:

Materials testing and inspection during construction: Section 01 45 29, TESTING LABORATORY SERVICES.

Safety Requirements: Section 00 72 00, GENERAL CONDITIONS, Article, ACCIDENT PREVENTION.

Submittal requirements as specified in Section 01 33 23 SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

Protection of existing utilities, fire protection services, existing equipment, roads, and pavements: Section 01 00 00, GENERAL REQUIREMENTS.

Subsurface Investigation: Section 01 00 00, GENERAL REQUIREMENTS, Article 1.11, PHYSICAL DATA.

Excavation, backfilling, site grade and utilities: Section 31 20 00, EARTH MOVING.

1.5 SUBMITTALS:

Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

Drawings and Design Data:

Submit drawings and data showing the method to be employed in dewatering excavated areas 30 days before commencement of excavation.

Material shall include: location, depth and size of wellpoints, headers, sumps, ditches, size and location of discharge lines, capacities of pumps and standby units, and detailed description of

12-05M

dewatering methods to be 31 23 19 - 3 employed to convey the water

from site to adequate disposal.

Include a written report outlining control procedures to be adopted if dewatering problem arises.

Materials submitted shall be in a format acceptable for inclusion in required permit applications to any and all regulatory agencies for which permits for discharge water from the dewatering system are required due to the discharge reaching regulated bodies of water.

Inspection Reports.

All required permits.

1.6 APPLICABLE PUBLICATIONS

The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only. Refer to the latest edition of all referenced Standards and codes.

Geotechnical Engineering Report of VAMC Community Living Center and Medical Imaging Center 500 West Fort Street Boise, Idaho by Materials Testing & Inspection, Boise Idaho, Stamped and Sealed May 31, 2011 by Kevin Schroeder, P.G. and David O. Cram, P.E. and all subsequent addenda.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.1 INSTALLATION:

Install a dewatering system (as required) to lower and control surface water in order to permit excavation, construction of structure, and placement of backfill materials to be performed under dry conditions. Make the dewatering system adequate to pre-drain the water-bearing strata above and below the bottom of structure foundations, utilities and other excavations.

In addition, reduce hydrostatic pressure head in water-bearing strata below structure foundations, utility lines, and other excavations, to extent that water levels in construction area are a minimum of 300 mm (1 foot) below prevailing excavation surface at all times.

3.2 OPERATION:

A. Prior to any excavation below the ground water table, place system into operation to lower water table as required and operate it continuously 24 hours a day, 7 days a week until utilities and structures have been

satisfactorily constructed, which includes the placement of backfill materials and dewatering is no longer required.

- B. Place an adequate weight of backfill material to prevent buoyancy prior to discontinuing operation of the system.

3.3 WATER DISPOSAL:

- A. Dispose of water removed from the excavations in such a manner as:
 - Will not endanger portions of work under construction or completed.
 - Will cause no inconvenience to Government or to others working near site.

Will comply with the stipulations of required permits for disposal of water.

Will Control Runoff: The Contractor shall be responsible for control of runoff in all work areas including but not limited to: excavations, access roads, parking areas, laydown, and staging areas. The Contractor shall provide, operate, and maintain all ditches, basins, sumps, culverts, site grading, and pumping facilities to divert, collect, and remove all water from the work areas. All water shall be removed from the immediate work areas and shall be disposed of in accordance with applicable permits.

- B. Excavation Dewatering:

The Contractor shall be responsible for providing all facilities required to divert, collect, control, and remove water from all construction work areas and excavations.

Drainage features shall have sufficient capacity to avoid flooding of work areas.

Drainage features shall be so arranged and altered as required to avoid degradation of the final excavated surface(s).

The Contractor shall utilize all necessary erosion and sediment control measures as described herein to avoid construction related degradation of the natural water quality.

- C. Dewatering equipment shall be provided to remove and dispose of all surface and ground water entering excavations, trenches, or other parts of the work during construction. Each excavation shall be kept dry during subgrade preparation and continually thereafter until the structure to be built, or the pipe to be installed therein, is completed to the extent that no damage from hydrostatic pressure, flotation, or other cause will result.

3.4 STANDBY EQUIPMENT:

- A. Provide complete standby equipment, installed and available for immediate operation, as may be required to adequately maintain dewatering on a continuous basis and in the event that all or any part of the system may become inadequate or fail.

3.5 CORRECTIVE ACTION:

- A. If dewatering requirements are not satisfied due to inadequacy or failure of the dewatering system (loosening of the foundation strata, or instability of slopes, or damage to foundations or structures), perform work necessary for reinstatement of foundation soil and damaged structure resulting from such inadequacy or failure by Contractor, at no additional cost to Government.

3.6 DAMAGES:

- A. Immediately repair damages to adjacent facilities caused by dewatering operations.

3.7 REMOVAL:

- A. Insure compliance with all conditions of regulating permits and provide such information to the COTR. Obtain written approval from COTR before discontinuing operation of dewatering system.

-----E N D -----

THIS PAGE INTENTIONALLY LEFT BLANK

SECTION 32 05 23

CEMENT AND CONCRETE FOR EXTERIOR IMPROVEMENTS

PART 1 - GENERAL

1.1 DESCRIPTION

This section shall cover site work concrete constructed upon the prepared subgrade and in conformance with the lines, grades, thickness, and cross sections shown. Construction shall include the following:

Curb and gutter.

Pedestrian Pavement: Sidewalks, grade slabs and curb ramps.

1.2 RELATED WORK

Laboratory and Field Testing Requirements: Section 01 45 29, TESTING LABORATORY SERVICES.

Subgrade Preparation: Section 31 20 00, EARTH MOVING.

Concrete Materials, Quality, Mixing, Design and Other Requirements: ISPCW Division 700.

Metal Components of Steps (Nosing and Railing): Section 05 50 00, METAL FABRICATIONS.

1.3 DESIGN REQUIREMENTS

Design all elements with the latest published version of applicable codes.

1.4 WEATHER LIMITATIONS

Placement of concrete shall be as specified under Article 3.8, COLD WEATHER and Article 3.7, HOT WEATHER of Section 03 30 00, CAST-IN-PLACE CONCRETE.

1.5 SELECT SUBBASE MATERIAL JOB-MIX

The Contractor shall retain and reimburse a testing laboratory to design a select subbase material mixture and submit a job-mix formula to the Resident Engineer, in writing, for approval. The formula shall include the source of materials, gradation, plasticity index, liquid limit, and laboratory compaction curves indicating maximum density at optimum moisture.

1.6 SUBMITTALS

In accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES, furnish the following:

Manufacturers' Certificates and Data certifying that the following materials conform to the requirements specified.

Expansion joint filler

Hot poured sealing compound

Reinforcement

4. Curing materials

C. Data and Test Reports: Select subbase material.

Job-mix formula.

Source, gradation, liquid limit, plasticity index, percentage of wear, and other tests as specified and in referenced publications. 1.7

APPLICABLE PUBLICATIONS

A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only. Refer to the latest edition of all referenced Standards and codes.

B. American Association of State Highway and Transportation Officials (AASHTO):

M31	.....	Deformed and Plain Billet Steel Bars for Concrete Reinforcement (ASTM A615/A615M-96A)
M55M/55M	.....	Welded Steel Wire Fabric for Concrete Reinforcement (ASTM A185)
M147	.....	Materials for Aggregate and Soil-Aggregate Subbase, Base and Surface Courses (R 1996)
M148	.....	Liquid Membrane-Forming Compounds for Curing Concrete (ASTM C309A)
M171	.....	Sheet Materials for Curing Concrete (ASTM C171)
M182	.....	Burlap Cloth Made from Jute or Kenaf
M213	.....	Preformed Expansion Joint Fillers for Concrete Paving and Structural Construction (Non- extruding and Resilient Bituminous Type) (ASTM D1751)
T99	.....	Moisture-Density Relations of Soils Using a 2.5 kg. (5.5 lb) Rammer and a 305 mm (12 in.) Drop
T180	.....	Moisture-Density Relations of Soils Using a 4.54 kg (10 lb.) Rammer and a 457 mm (18 in.) Drop

C. American Society for Testing and Materials (ASTM):

C94/C94MReady-Mixed Concrete

C143/C143MSlump of Hydraulic Cement Concrete

D. Idaho Standards for Public Works Construction - Current Edition.

E. Geotechnical Engineering Report of VAMC Community Living Center and Medical Imaging Center 500 West Fort Street Boise, Idaho by Materials Testing & Inspection, Boise Idaho, Stamped and Sealed May 31, 2011 by Kevin Schroeder, P.G. and David O. Cram, P.E. and all subsequent addenda..

PART 2 - PRODUCTS

2.1 GENERAL

Concrete shall be Type C, air-entrained as specified in Section 03 30 00, CAST-IN-PLACE CONCRETE, with the following exceptions:

TYPE	MAXIMUM SLUMP*
Curb & Gutter	75 mm (3")
Pedestrian Pavement	75 mm (3")
Vehicular Pavement	50 mm (2") (Machine Finished) 100 mm (4") (Hand Finished)
Equipment Pad	75 to 100 mm (3" to 4")
* For concrete to be vibrated: Slump as determined by C143. ASTM Tolerances as established by ASTM C94.	

2.2 REINFORCEMENT

The type, amount, and locations of steel reinforcement shall be as shown on the drawings and in the specifications.

Welded wire-fabric shall conform to AASHTO M55.

Dowels shall be plain steel bars conforming to AASHTO M31 or M42. Tie bars shall be deformed steel bars conforming to AASHTO M31 or M42.

2.3 SELECT SUBBASE

Subbase material shall consist of select granular material composed of sand, sand-gravel, crushed stone, crushed or granulated slag, with or without soil binder, or combinations of these materials conforming to AASHTO M147, Grading E or F.

Materials meeting other gradations than that noted will be acceptable whenever the gradations are within a tolerance of three to five percent, plus or minus, of the single gradation established by the job-mix formula.

Subbase material shall produce a compacted, dense-graded course, meeting the density requirement specified herein.

2.4 FORMS

A. Use metal or wood forms that are straight and suitable in cross-section, depth, and strength to resist springing during depositing and consolidating the concrete, for the work involved.

Do not use forms if they vary from a straight line more than 3 mm (1/8 inch) in any 3000 mm (ten foot) long section, in either a horizontal or vertical direction.

Wood forms should be at least 50 mm (2 inches) thick (nominal). Wood forms shall also be free from warp, twist, loose knots, splits, or other defects. Use approved flexible or curved forms for forming radii. 2.5

CONCRETE CURING MATERIALS

- A. Concrete curing materials shall conform to one of the following:
- Burlap conforming to AASHTO M182 having a weight of 233 grams (seven ounces) or more per square meter (yard) when dry.
 - Impervious Sheeting conforming to AASHTO M171.
 - Liquid Membrane Curing Compound conforming to AASHTO M148 (ASTM C309), Type 1 and shall be free of paraffin or petroleum.

2.6 EXPANSION JOINT FILLERS

Material shall conform to AASHTO M213.

2.7 COLD-APPLIED JOINT SEALANTS

- A. Single-Component, Nonsag, Silicone Joint Sealant for Concrete: ASTM D 5893, Type NS.
1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - Crafco Inc., an ERGON company; RoadSaver Silicone.
 - Dow Corning Corporation; 888.
 - Pecora Corporation; 301 NS.
- B. Single-Component, Self-Leveling, Silicone Joint Sealant for Concrete: ASTM D 5893, Type SL.
1. Products: Subject to compliance with requirements available products that may be incorporated into the Work include, but are not limited to, the following:
 - Crafco Inc., an ERGON company; RoadSaver Silicone SL.
 - Dow Corning Corporation; 890-SL.
 - Pecora Corporation; 300 SL.

2.8 JOINT-SEALANT BACKER MATERIALS

Round Backer Rods for Cold- and Hot-Applied Joint Sealants: ASTM D 5249, Type 1, of diameter and density required to control sealant depth and prevent bottom-side adhesion of sealant.

Round Backer Rods for Cold-Applied Joint Sealants: ASTM D 5249, Type 3, of diameter and density required to control joint-sealant depth and prevent bottom-side adhesion of sealant.

- C. Backer Strips for Cold- and Hot-Applied Joint Sealants: ASTM D 5249; Type 2; of thickness and width required to control joint-sealant depth, prevent bottom-side adhesion of sealant, and fill remainder of joint opening under sealant.

PART 3 - EXECUTION

3.1 SUBGRADE PENETRATION

- A. Prepare, construct, and finish the subgrade as specified in Section 31 20 00, EARTH MOVING.
- B. Maintain the subgrade in a smooth, compacted condition, in conformance with the required section and established grade until the succeeding operation has been accomplished.

3.2 SELECT SUBBASE

- A. Mixing: Proportion the select subbase by weight or by volume in quantities so that the final approved job-mixed formula gradation, liquid limit, and plasticity index requirements will be met after subbase course has been placed and compacted. Add water in approved quantities, measured by weight or volume, in such a manner to produce a uniform blend.

- B. Placing:

Place the mixed material on the prepared subgrade in a uniform layer to the required contour and grades, and to a loose depth not to exceed 200 mm (8 inches), and that when compacted, will produce a layer of the designated thickness.

When the designated compacted thickness exceeds 150 mm (6 inches), place the material in layers of equal thickness. Remove unsatisfactory areas and replace with satisfactory mixture, or mix the material in the area.

In no case will the addition of thin layers of material be added to the top layer in order to meet grade.

If the elevation of the top layer is 13 mm (1/2 inch) or more below the grade, excavate the top layer and replace with new material to a depth of at least 75 mm (3 inches) in compacted thickness.

- C. Compaction:

Perform compaction with approved equipment (hand or mechanical) well suited to the material being compacted.

Moisten or aerate the material as necessary to provide the moisture content that will readily facilitate obtaining the specified compaction with the equipment used.

3. Compact each layer to at least 95 percent or 100 percent of maximum density as determined by AASHTO T180 or AASHTO T99 respectively.

D. Smoothness Test and Thickness Control:

Test the completed subbase for grade and cross section with a straight edge.

The surface of each layer shall not show any deviations in excess of 10 mm (3/8 inch).

The completed thickness shall be within 13 mm (1/2 inch) of the thickness as shown.

E. Protection:

Maintain the finished subbase in a smooth and compacted condition until the concrete has been placed.

When Contractor's subsequent operations or adverse weather disturbs the approved compacted subbase, excavate, and reconstruct it with new material meeting the requirements herein specified, at no additional cost to the VA.

3.3 SETTING FORMS

A. Base Support:

Compact the base material under the forms true to grade so that, when set, they will be uniformly supported for their entire length at the grade as shown.

Correct imperfections or variations in the base material grade by cutting or filling and compacting.

B. Form Setting:

Set forms sufficiently in advance of the placing of the concrete to permit the performance and approval of all operations required with and adjacent to the form lines.

Set forms to true line and grade and use stakes, clamps, spreaders, and braces to hold them rigidly in place so that the forms and joints are free from play or movement in any direction.

Forms shall conform to line and grade with an allowable tolerance of 3 mm (1/8 inch) when checked with a straightedge and shall not deviate from true line by more than 6 mm (1/4 inch) at any point.

Do not remove forms until removal will not result in damaged concrete or at such time to facilitate finishing.

Clean and oil forms each time they are used.

C. The Contractor's Registered Professional Land Surveyor, specified in Section 00 72 00, GENERAL CONDITIONS, shall establish and control the

alignment and the grade elevations of the forms or concrete slipforming machine operations.

Make necessary corrections to forms immediately before placing concrete.

When any form has been disturbed or any subgrade or subbase has become unstable, reset and recheck the form before placing concrete. 3.4

EQUIPMENT

The Resident Engineer shall approve equipment and tools necessary for handling materials and performing all parts of the work prior to commencement of work.

Maintain equipment and tools in satisfactory working condition at all times.

3.5 PLACING REINFORCEMENT

Reinforcement shall be free from dirt, oil, rust, scale or other substances that prevent the bonding of the concrete to the reinforcement.

Before the concrete is placed, the Resident Engineer shall approve the reinforcement, which shall be accurately and securely fastened in place with suitable supports and ties. The type, amount, and position of the reinforcement shall be as shown.

3.6 PLACING CONCRETE - GENERAL

Obtain approval of the Resident Engineer before placing concrete.

Remove debris and other foreign material from between the forms before placing concrete. Obtain approval of the Resident Engineer before placing concrete.

Before the concrete is placed, uniformly moisten the subgrade, base, or subbase appropriately, avoiding puddles of water.

Convey concrete from mixer to final place of deposit by a method which will prevent segregation or loss of ingredients. Deposit concrete so that it requires as little handling as possible.

While being placed, spade or vibrate and compact the concrete with suitable tools to prevent the formation of voids or honeycomb pockets. Vibrate concrete well against forms and along joints. Over-vibration or manipulation causing segregation will not be permitted. Place concrete continuously between joints without bulkheads.

Install a construction joint whenever the placing of concrete is suspended for more than 30 minutes and at the end of each day's work.

- G. Workmen or construction equipment coated with foreign material shall not be permitted to walk or operate in the concrete during placement and finishing operations.

3.7 PLACING CONCRETE FOR CURB AND GUTTER, PEDESTRIAN PAVEMENT, AND EQUIPMENT PADS

- A. Place concrete in the forms in one layer of such thickness that, when compacted and finished, it will conform to the cross section as shown.
- B. Deposit concrete as near to joints as possible without disturbing them but do not dump onto a joint assembly.
- C. After the concrete has been placed in the forms, use a strike-off guided by the side forms to bring the surface to the proper section to be compacted.
- D. Consolidate the concrete thoroughly by tamping and spading, or with approved mechanical finishing equipment.
- E. Finish the surface to grade with a wood or metal float.
- F. All Concrete pads and pavements shall be constructed with sufficient slope to drain properly.

3.8 PLACING CONCRETE FOR VEHICULAR PAVEMENT: - NOT USED.

3.9 CONCRETE FINISHING - GENERAL

- A. The sequence of operations, unless otherwise indicated, shall be as follows:
 - Consolidating, floating, straight-edging, troweling, texturing, and edging of joints.
 - Maintain finishing equipment and tools in a clean and approved condition.

3.10 CONCRETE FINISHING CURB AND GUTTER

Round the edges of the gutter and top of the curb with an edging tool to a radius of 6mm (1/4 inch) or as otherwise detailed.

Float the surfaces and finish with a smooth wood or metal float until true to grade and section and uniform in textures.

Finish the surfaces, while still wet, with a bristle type brush with longitudinal strokes.

Immediately after removing the front curb form, rub the face of the curb with a wood or concrete rubbing block and water until blemishes, form marks, and tool marks have been removed. Brush the surface, while still wet, in the same manner as the gutter and curb top.

Except at grade changes or curves, finished surfaces shall not vary more than 3 mm (1/8 inch) for gutter and 6 mm (1/4 inch) for top and face of curb, when tested with a 3000 mm (10 foot) straightedge.

Remove and reconstruct irregularities exceeding the above for the full length between regularly scheduled joints.

Correct any depressions which will not drain.

Visible surfaces and edges of finished curb and gutter shall be free of blemishes, form marks, and tool marks, and shall be uniform in color, shape, and appearance.

3.11 CONCRETE FINISHING PEDESTRIAN PAVEMENT

A. Walks, Grade Slabs, and Wheelchair Curb Ramps:

Finish the surfaces to grade and cross section with a metal float, trowled smooth and finished with a broom moistened with clear water.

Brooming shall be transverse to the line of traffic.

Finish all slab edges, including those at formed joints, carefully with an edger having a radius as shown on the Drawings.

Unless otherwise indicated, edge the transverse joints before brooming. The brooming shall eliminate the flat surface left by the surface face of the edger. Execute the brooming so that the corrugation, thus produced, will be uniform in appearance and not more than 2 mm (1/16 inch) in depth.

The completed surface shall be uniform in color and free of surface blemishes, form marks, and tool marks. The finished surface of the pavement shall not vary more than 5 mm (3/16 inch) when tested with a 3000 mm (10 foot) straightedge.

The thickness of the pavement shall not vary more than 6 mm (1/4 inch).

Remove and reconstruct irregularities exceeding the above for the full length between regularly scheduled joints.

All edges shall have a 1/4" (.6mm) radius.

3.12 CONCRETE FINISHING FOR VEHICULAR PAVEMENT - NOT

USED. 3.13 CONCRETE FINISHING EQUIPMENT PADS

After the surface has been struck off and screeded to the proper elevation, give it a smooth dense float finish, free from depressions or irregularities.

Carefully finish all slab edges with an edger having a radius as shown in the Drawings.

After removing the forms, rub the faces of the pad with a wood or concrete rubbing block and water until blemishes, form marks, and tool marks have been removed. The finish surface of the pad shall not vary more than 3 mm (1/8 inch) when tested with a 3000 mm (10 foot) straightedge.

D. Correct irregularities exceeding the above.

3.14 JOINTS - GENERAL

Place joints, where shown, conforming to the details as shown, and perpendicular to the finished grade of the concrete surface. Joints shall be straight and continuous from edge to edge of the pavement.

3.15 CONTRACTION JOINTS

Cut joints to depth as shown with a grooving tool or jointer of a radius as shown.

Construct joints in curbs and gutters by inserting 3 mm (1/8 inch) steel plates conforming to the cross sections of the curb and gutter.

Plates shall remain in place until concrete has set sufficiently to hold its shape and shall then be removed.

Finish edges of all joints with an edging tool having a 1/4" (.6mm) radius.

Score pedestrian pavement with a standard grooving tool or jointer.

3.16 EXPANSION JOINTS

A. Use a preformed expansion joint filler material of the thickness as shown to form expansion joints.

B. Material shall extend the full depth of concrete, cut and shaped to the cross section as shown, except that top edges of joint filler shall be below the finished concrete surface where shown to allow for sealing.

C. Anchor with approved devices to prevent displacing during placing and finishing operations.

D. Round the edges of joints with an edging tool.

E. Form expansion joints as follows:

Without dowels, about structures and features that project through, into, or against any site work concrete construction.

Using joint filler of the type, thickness, and width as shown.

Installed in such a manner as to form a complete, uniform separation between the structure and the site work concrete item.

F. Form expansion joints of preformed joint-filler strips abutting concrete curbs, catch basins, manholes, inlets, structures, other fixed objects, and where indicated.

3.17 CONSTRUCTION JOINTS

Not used.

Place transverse construction joints of the type shown, where indicated and whenever the placing of concrete is suspended for more than 30 minutes.

Use a butt-type joint with dowels in curb and gutter.

Not used.

3.18 COLD-APPLIED JOINT SEALANTS

A. Single-Component, Nonsag, Silicone Joint Sealant for Concrete:

ASTM D 5893, Type NS.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

Crafco Inc., an ERGON company; RoadSaver Silicone.

Dow Corning Corporation; 888.

Pecora Corporation; 301 NS.

B. Single-Component, Self-Leveling, Silicone Joint Sealant for Concrete: ASTM D 5893, Type SL.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

Crafco Inc., an ERGON company; RoadSaver Silicone SL.

Dow Corning Corporation; 890-SL.

Pecora Corporation; 300 SL.

3.19 FORM REMOVAL

Forms shall remain in place at least 12 hours after the concrete has been placed. Remove forms without injuring the concrete.

Do not use bars or heavy tools against the concrete in removing the forms. Promptly repair any concrete found defective after form removal. **3.20 CURING OF CONCRETE**

Cure concrete by one of the following methods appropriate to the weather conditions and local construction practices, against loss of moisture, and rapid temperature changes for at least seven days from the beginning of the curing operation. Protect unhardened concrete from rain and flowing water. All equipment needed for adequate curing and protection of the concrete shall be on hand and ready to install before actual concrete placement begins. Provide protection as necessary to prevent cracking of the pavement due to temperature changes during the curing period. If any selected method of curing does not afford the proper curing and protection against concrete cracking, remove and replace the damaged pavement and employ another method of curing as directed by the Resident Engineer.

Burlap Mat: Provide a minimum of two layers kept saturated with water for the curing period. Mats shall overlap each other at least 150 mm (6 inches).

Impervious Sheeting: Use waterproof paper, polyethylene-coated burlap, or polyethylene sheeting. Polyethylene shall be at least 0.1 mm (4 mils) in thickness. Wet the entire exposed concrete surface with a fine spray of water and then cover with the sheeting material. Sheets shall overlap each other at least 300 mm (12 inches). Securely anchor sheeting.

Liquid Membrane Curing:

1. Apply pigmented membrane-forming curing compound in two coats at right angles to each other at a rate of 5 m²/L (200 square feet per gallon) for both coats.

Do not allow the concrete to dry before the application of the membrane.

Cure joints designated to be sealed by inserting moistened paper or fiber rope or covering with waterproof paper prior to application of the curing compound, in a manner to prevent the curing compound entering the joint.

Immediately re-spray any area covered with curing compound and damaged during the curing period.

3.21 CLEANING

A. After completion of the curing period:

Remove the curing material (other than liquid membrane).

Sweep the concrete clean.

After removal of all foreign matter from the joints, seal joints as herein specified.

Clean the entire concrete of all debris and construction equipment as soon as curing and sealing of joints has been completed.

3.22 PROTECTION

The contractor shall protect the concrete against all damage prior to final acceptance by the Government. Remove concrete containing excessive cracking, fractures, spalling, or other defects and reconstruct the entire section between regularly scheduled joints, when directed by the Resident Engineer, and at no additional cost to the Government. Exclude traffic from vehicular pavement until the concrete is at least seven days old, or for a longer period of time if so directed by the Resident Engineer.

3.23 FINAL CLEAN-UP

Remove all debris, rubbish and excess material from the Station.

- - - E N D - - -

SECTION 32 12 16
ASPHALT PAVING

PART 1 - GENERAL

1.1 DESCRIPTION

A. This work shall cover the composition, mixing, construction upon the prepared subgrade, and the protection of hot asphalt concrete pavement. The hot asphalt concrete pavement shall consist of an aggregate or asphalt base course and asphalt surface course constructed in conformity with the lines, grades, thickness, and cross sections as shown. Each course shall be constructed to the depth, section, or elevation required by the drawings and shall be rolled, finished, and approved before the placement of the next course.

1.2 RELATED WORK

Laboratory and field testing requirements: Section 01 45 29, TESTING LABORATORY SERVICES.

Subgrade Preparation: Paragraph 3.3 and Section 31 20 00, EARTH MOVING.

1.3 INSPECTION OF PLANT AND EQUIPMENT

A. The COTR shall have access at all times to all parts of the material producing plants for checking the mixing operations and materials and the adequacy of the equipment in use.

1.4 ALIGNMENT AND GRADE CONTROL

A. The Contractor's Registered Professional Land Surveyor specified in Section 00 72 00, GENERAL CONDITIONS shall establish and control the pavement (aggregate or asphalt base course and asphalt surface course) alignments, grades, elevations, and cross sections as shown on the Drawings.

1.5 SUBMITTALS

In accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES, furnish the following:

Data and Test Reports:

Aggregate Base Course: Sources, gradation, liquid limit, plasticity index, percentage of wear, and other tests required by State Highway Department.

Asphalt Base/Surface Course: Aggregate source, gradation, soundness loss, percentage of wear, and other tests required by State Highway Department.

Job-mix formula.

C. Certifications:

Asphalt prime and tack coat material certificate of conformance to State Highway Department requirements.

Asphalt cement certificate of conformance to State Highway Department requirements.

Job-mix certification - Submit plant mix certification that mix equals or exceeds the State Highway Specification.

D. Provide MSDS (Material Safety Data Sheets) for all chemicals used on ground.

1.6 APPLICABLE PUBLICATIONS

The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only. Refer to the latest edition of all referenced Standards and codes.

Idaho Transportation Department (ITD) - Standard Specifications for Highway Construction - 2004

Geotechnical Engineering Report of Proposed Commercial Redevelopment - Mt. Cove Elevator Shaft, Building 33, Veteran's Hospital, Boise, Idaho by Materials Testing & inspection, Boise Idaho, Stamped and Sealed August 27, 2010 by Kevin L. Schroeder, P.G. and Colin J. Basye, P.E. and all subsequent addendums.

Idaho Standards for Public Works Construction - Current Edition.

PART 2 - PRODUCTS

2.1 GENERAL

Aggregate base and asphalt concrete materials shall conform to the requirements of the Geotechnical Report and the following and other appropriate sections of the latest version of the State Highway Material Specifications, including amendments, addenda and errata. Where the term "Engineer" or "Commission" is referenced in the State Highway Specifications, it shall mean the VA COTR or VA Contracting Officer.

Where conflicts arise between this specification and the requirements in the latest version of the State Highway Specifications, the State Specifications shall control.

2.2 AGGREGATES

A. Provide aggregates that meet the requirements of Class III

2.3 ASPHALTS

A. Comply with provisions of Asphalt Institute Specification SS2:

1. Asphalt cement: PG 58-28

2. Tack coat or (Bond joints): Uniformly emulsified, grade SS-1H, as needed between surfaces of new/existing.

PART 3 - EXECUTION

3.1 GENERAL

The Asphalt Concrete Paving equipment, weather limitations, job-mix formula, mixing, construction methods, compaction, finishing, tolerance, and protection shall conform to the requirements of the Geotechnical Report and appropriate sections of the State Highway Specifications for the type of material specified.

Where conflicts arise between this specification and the requirements in the latest version of the State Highway Specifications, the State Specifications shall control.

3.2 MIXING ASPHALTIC CONCRETE MATERIALS

- A. Provide hot plant-mixed asphaltic concrete paving materials.

Temperature leaving the plant: 143 degrees C(290 degrees F) minimum, 160 degrees C(320 degrees F) maximum.

Temperature at time of placing: 138 degrees C(280 degrees F) minimum.

3.3 SUBGRADE

Shape to line and grade and compact with self-propelled rollers.

All depressions that develop under rolling shall be filled with acceptable material and the area re-rolled.

Soft areas shall be removed and filled with acceptable materials and the area re-rolled.

Should the subgrade become rutted or displaced prior to the placing of the subbase, it shall be reworked to bring to line and grade.

Proof-roll the subgrade with maximum 45 tonne (50 ton) gross weight dump truck as directed by VA COTR or VA Contracting Officer. If pumping, pushing, or other movement is observed, rework the area to provide a stable and compacted subgrade.

3.4 BASE COURSES

- A. Subbase (when required)

Spread and compact to the thickness shown on the drawings.

Rolling shall begin at the sides and continue toward the center and shall continue until there is no movement ahead of the roller.

After completion of the subbase rolling there shall be no hauling over the subbase other than the delivery of material for the top course.

- B. Base

1. Spread and compact to the thickness shown on the drawings.

Rolling shall begin at the sides and continue toward the center and shall continue until there is no movement ahead of the roller. After completion of the base rolling there shall be no hauling over the base other than the delivery of material for the top course. Thickness tolerance: Provide the compacted thicknesses shown on the Drawings within a tolerance of minus 0.0mm (0.0") to plus 12.7mm (0.5"). Smoothness tolerance: Provide the lines and grades shown on the Drawings within a tolerance of 5mm in 3m (3/16 inch in ten feet). Moisture content: Use only the amount of moisture needed to achieve the specified compaction.

3.5 PLACEMENT OF ASPHALTIC CONCRETE PAVING

- A. Remove all loose materials from the compacted base.
- B. Apply the specified prime coat, and tack coat where required, and allow to dry in accordance with the manufacturer's recommendations as approved by the Architect or Engineer.
- C. Receipt of asphaltic concrete materials:
Do not accept material unless it is covered with a tarpaulin until unloaded, and unless the material has a temperature of not less than 130 degrees C (280 degrees F).
Do not commence placement of asphaltic concrete materials when the atmospheric temperature is below 10 degrees C (50 degrees F), not during fog, rain, or other unsuitable conditions.
- D. Spreading:
Spread material in a manner that requires the least handling. Where thickness of finished paving will be 76mm (3") or less, spread in one layer.
- E. Rolling:
After the material has been spread to the proper depth, roll until the surface is hard, smooth, unyielding, and true to the thickness and elevations shown on the drawings.
Roll in at least two directions until no roller marks are visible.
Finished paving smoothness tolerance:
No depressions which will retain standing water.
No deviation greater than 3mm in 1.8m (1/8" in six feet).

3.6 APPLICATION OF SEAL COAT

Prepare the surfaces, mix the seal coat material, and apply in accordance with the manufacturer's recommendations as approved by the Architect or Engineer.
Apply one coat of the specified sealer.

C. Achieve a finished surface seal which, when dry and thoroughly set, is smooth, tough, resilient, of uniform black color, and free from coarse textured areas, lap marks, ridges, and other surface irregularities. 3.7

PROTECTION

A. Protect the asphaltic concrete paved areas from traffic until the sealer is set and cured and does not pick up under foot or wheeled traffic. 3.8

FINAL CLEAN-UP

A. Remove all debris, rubbish, and excess material from the work area.

- - - E N D - - -

THIS PAGE INTENTIONALLY LEFT BLANK

SECTION 32 84 00
PLANTING IRRIGATION

PART 1 - GENERAL

1.1 SUMMARY

This Section includes valves, piping, sprinklers, specialties, accessories, controls, and wiring for lawn and landscape irrigation systems.

Related Sections: The following Sections contain requirements that relate to this Section:

Division 22, Section "Plumbing" for water supply.

Division 26, Sections for electrical power materials and installations.

1.2 SYSTEM PERFORMANCE REQUIREMENTS

A. Location of Sprinklers and Devices: Design location is approximate. Make minor adjustments necessary to avoid plantings and obstructions such as signs and light standards.

B. Minimum Water Coverage: Not less than:

Turf Areas: 100 percent.

Other Planting Areas: 100 percent.

C. Components and Installation: Capable of producing piping systems with the following minimum working pressure ratings except where indicated otherwise.

Pressure Piping: 150 psig.

Circuit and Drain Piping: 100 psig.

1.3 SUBMITTALS

A. Product data including pressure rating, rated capacity, settings, and electrical data of selected models for the following:

Water meters.

Backflow preventers, including test equipment.

Pressure regulators.

Valves, including general-duty, underground, manual, and automatic control, and quick-coupler types, and valve boxes.

Sprinklers, including emitters, drip tubes, and devices.

Controls, including controller wiring diagrams.

Wiring.

Water hammer arresters.

Area drains.

B. Wiring diagrams for electrical controllers, valves, and devices.

C. When irrigation plan is not provided by the Architect, the Contractor shall submit shop drawings showing irrigation system, including plan layout and locations, types, sizes, capacities, and flow characteristics of irrigation system components. Include water meters, backflow preventers, valves, piping, sprinklers and devices, accessories, controls, and wiring. Show areas of sprinkler spray and overspray.

1.4 QUALITY ASSURANCE

Comply with requirements of utility supplying water for prevention of backflow and back-siphonage.

Installer Qualifications: Engage an experienced Installer who has completed irrigation systems similar in material, design, and extent to that indicated for Project that have resulted in construction with a record of successful in-service performance.

Provide underground irrigation system as a complete unit produced by a single acceptable manufacturer, including heads, valves, controls, and accessories.

1.5 PROJECT CONDITIONS

A. Perform site survey, research public utility records, and verify existing utility locations. Verify that irrigation system piping may be installed in compliance with original design and referenced standards.

1.6 SEQUENCING AND SCHEDULING

A. Coordinate irrigation systems work with landscape work specified in Division 32 Section "Landscape Improvements."

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. As indicated on the drawings.

2.2 PRESSURE PIPE: Comply with following:

A. 3" and smaller, PVC plastic pipe, ASTM D2241, Class 200 PVC, SDR 21 solvent weld pipe.

2.3 PIPE FITTINGS: Comply with following:

A. For PVC plastic pipe, ASTM D 2464 Schedule 80, socket fittings with ASTM D 2564 solvent cement.

2.4 CIRCUIT PIPE (DOWNSTREAM FROM CIRCUIT VALVES): Comply with the following:

A. PVC plastic pipe, ASTM D 2241, Class 200 PVC, SDR21 solvent weld

pipe.

2.5 VALVES: Manufacturer's standard, and as follows:

Provide cast bronze bodies, unless otherwise indicated.

Manual Circuit Valves: Globe valves

Key Operated Valves: Manual valves, fitted for key operation.

1. Furnish 2 valve keys, three feet long with tee handles and key end to fit valves.

Automatic Circuit Valves: Globe valves operated by low-power solenoid, normally closed, manual flow adjustment.

Automatic Drain Valves: Designated to open for drainage when line pressure drops below 3 psi.

2.6 SPRINKLER HEADS: Manufacturer's standard unit designed to provide uniform coverage over entire area of spray at available water pressure, as follows:

Flush surface: Fixed pattern, with screw-type flow adjustment.

Bubbler: Fixed pattern, with screw-type flow adjustment.

Shrubbery: Fixed pattern, with screw-type flow adjustment.

Pop-Up Spray: Fixed pattern, with screw-type flow adjustment and stainless steel retraction spring.

Pop-Up Rotary Spray: Gear drive, full circle and adjustable part circle type.

Pop-Up Rotary Impact: Impact drive, full circle and part circle as indicated.

Above-Ground Rotary Impact: Impact drive, full circle and part circle as indicated.

2.7 VALVE BOX: Thermoplastic. Size as required for access; maximum of two valves per box.

2.8 VALVE COVER AND FRAME: Thermoplastic snap-top lid with provision for locking.

2.9 AUTOMATIC CONTROL SYSTEM

General: As indicated on Drawings.

Exterior Control Enclosure: Manufacturer's standard weatherproof enclosure with locking cover, complying with NEC (National Electric Code).

Interior Control Enclosures: Manufacturer's standard with locking cover, complying with NFPA 70. Coordinate location with electrical plans.

Transformer: To convert building service voltage to control voltage of 24 volts.

Circuit Control: Each circuit variable from approximately 5 to 60

minutes. Include switch 32 84 00-3 for manual or automatic

operation of each circuit.

F. Timing Device: Adjustable, 24-hour and 7 or 14-day period.

2.10 DRAINAGE BACKFILL: Cleaned gravel or crushed stone, graded from 3" maximum to 3/4" minimum.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Investigate and determine available water supply water pressure and flow characteristics.

3.2 PREPARATION

A. Set stakes to identify proposed sprinkler locations. Obtain Owner's approval before excavation.

3.3 INSTALLATION

A. General: Unless otherwise indicated, comply with requirements of Uniform Plumbing Code.

B. Connection to Main: As indicated on drawings.

1. As a minimum, install tee, valve, union and other fittings as needed to provide a complete connection.

C. Minimum Cover: Provide following minimum cover over top of installed piping:

Mainline: 18".

Circuit Pipe: 12".

Sleeves: 18".

D. Backflow Preventer: Provide union on downstream side.

E. Water Hammer Arrester: Install between connection to building main and circuit valves, inside building or in valve box.

F. Circuit Valves: Install in valve box, arranged for easy adjustment and removal.

Provide union on downstream side.

Adjust automatic control valves to provide flow rate of rated operating pressure required for each sprinkler circuit.

G. Piping: Lay pipe on solid subbase, uniformly sloped without humps or depressions.

For circuit piping, slope to drain valve at least 1/2" in 10' of run.

At wall penetrations, pack the opening around pipe with non-shrink grout.

At exterior face, leave a perimeter slot approximately 1/2" wide by 3/4" deep.

Fill this slot with backer rod and an acceptable elastomeric sealant. Repair below grade waterproofing disturbed by this work and make penetration

watertight.

3. Install PVC pipe in dry weather when temperature is above 40 degrees F (4 degrees C) before testing, unless otherwise recommended by manufacturer.
 - H. Sprinkler Heads: Flush circuit lines with full head of water and install heads after hydrostatic test is complete.
Install lawn heads at manufacturer's recommended heights.
Install shrubbery heads at heights indicated.
Locate part-circle heads to maintain a minimum distance of 4" from walls and 2" from other boundaries, unless otherwise indicated.
 - I. Dielectric Protection: Use dielectric fittings at connection where pipes of dissimilar metal are joined.
- 3.4 FIELD QUALITY CONTROL
- A. Testing: Perform hydrostatic test of piping and valves before backfilling trenches. Piping may be tested in sections to expedite work.
 1. Cap and subject the piping system to a static water pressure of 50 psig (345 kPa) above the operating pressure without exceeding pressure rating of piping system materials. Isolate test source and allow to stand for 4 hours. Leaks and loss in test pressure constitute defects that must be repaired.
 2. Repair leaks and defects with new materials and retest system or portion thereof until satisfactory results are obtained.
- 3.5 CLEANING AND ADJUSTING
- Flush dirt and debris from piping before installing sprinklers and other devices.
- Adjust automatic control valves to provide flow rate of rated operating pressure required for each sprinkler circuit.
- Carefully adjust lawn sprinklers so they will be flush with, or not more than 1/2 inch (13 mm) above, finish grade after completion of landscape work.
- Adjust settings of controllers and automatic control valves.
- 3.6 DEMONSTRATION
- Demonstrate to Owner that system meets coverage requirements and that automatic controls function properly.
- Demonstrate to Owner's maintenance personnel operation of equipment, sprinklers, specialties, and accessories. Review operating and maintenance information.
- Provide 7 day written notice in advance of demonstration.

- - - E N D - - -

THIS PAGE INTENTIONALLY LEFT BLANK

SECTION 32 93 00

PLANTS

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:

Trees.

Shrubs.

Ground covers.

Plants.

Lawns.

Topsoil and soil amendments.

Initial maintenance of landscape materials.

B. Related Sections: The following Sections contain requirements that relate to this Section:

1. Division 32 Section "Planting Irrigation".

1.3 SUBMITTALS

A. General: Submit each item in this Article according to the Conditions of the Contract and Division 1 Specification Sections.

B. Product certificates signed by manufacturer certifying that their products comply with specified requirements.

Manufacturer's certified analysis for standard products.

Analysis for other materials by a recognized laboratory made according to methods established by the Association of Official Analytical Chemists, where applicable.

Label data substantiating that plants, trees, shrubs, and planting materials comply with specified requirements.

C. Planting schedule indicating anticipated dates and locations for each type of planting.

1.4 QUALITY ASSURANCE

Installer Qualifications: Engage an experienced Installer who has completed landscaping work similar in material, design, and extent to that indicated for this Project and with a record of successful landscape establishment.

1. Installer's Field Supervision: Require Installer to maintain an experienced full-time supervisor on the Project site during times that landscaping is in progress.

Provide quality, size, genus, species, and variety of trees and shrubs indicated, complying with applicable requirements of ANSI Z60.1 "American Standard for Nursery Stock."

Topsoil Analysis: Furnish a soil analysis made by a qualified independent soil-testing agency stating percentages of organic matter, inorganic matter (silt, clay, and sand), deleterious material, pH, and mineral and plant - nutrient content of topsoil.

1. Report suitability of topsoil for growth of applicable planting material. State recommended quantities of nitrogen, phosphorus, and potash nutrients and any limestone, aluminum sulfate, or other soil amendments to be added to produce a satisfactory topsoil.

Measurements: Measure trees and shrubs according to ANSI Z60.1 with branches and trunks or canes in their normal position. Do not prune to obtain required sizes. Take caliper measurements 6 inches (150 mm) above ground for trees up to 4-inch (100-mm) caliper size, and 12 inches (300 mm) above ground for larger sizes. Measure main body of tree or shrub for height and spread; do not measure branches or roots tip-to-tip.

Preinstallation Conference: General Contractor to conduct conference at project site for planting coordination to verify compliance with requirements of project plans and local jurisdiction responsible for approval of the planting condition.

1.5 DELIVERY, STORAGE, AND HANDLING

Packaged Materials: Deliver packaged materials in containers showing weight, analysis, and name of manufacturer. Protect materials from deterioration during delivery and while stored at site.

Seed: Deliver seed in original sealed, labeled, and undamaged containers.

Trees and Shrubs: Deliver freshly dug trees and shrubs. Do not prune before delivery, except as approved by Owner. Protect bark, branches, and root systems from sun scald, drying, sweating, whipping, and other handling and tying damage. Do not bend or bind-tie trees or shrubs in such a manner as to destroy natural shape. Provide protective covering during delivery. Do not drop trees and shrubs during delivery.

1. Immediately after digging bare-root stock, pack root system in wet straw, hay, or other suitable material to keep root system moist until planting.

Handle balled and burlapped stock by the root ball.

- E. Deliver trees, shrubs, ground covers, and plants after preparations for planting have been completed and install immediately. If planting is delayed more than 6 hours after delivery, set planting materials in shade, protect from weather and mechanical damage, and keep roots moist.
- Heel-in bare-root stock. Soak roots in water for 2 hours if dried out.
- Set balled stock on ground and cover ball with soil, peat moss, sawdust, or other acceptable material.
- Do not remove container-grown stock from containers before time of planting.
- Water root systems of trees and shrubs stored on site with a fine-mist spray. Water as often as necessary to maintain root systems in a moist condition.

1.6 PROJECT CONDITIONS

Utilities: Determine location of above grade and underground utilities and perform work in a manner which will avoid damage. Hand excavate, as required. Maintain grade stakes until removal is mutually agreed upon by parties concerned.

Excavation: When conditions detrimental to plant growth are encountered, such as rubble fill, adverse drainage conditions, or obstructions, notify Owner before planting.

1.7 COORDINATION AND SCHEDULING

A. Coordinate installation of planting materials during normal planting seasons for each type of plant material required.

1.8 WARRANTY

General Warranty: The special warranty specified in this Article shall not deprive the Owner of other rights the Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by the GC under requirements of the Contract Documents.

Special Warranty: Warrant the following living planting materials for a period of one year after date of Substantial Completion, against defects including death and unsatisfactory growth, except for defects resulting from lack of adequate maintenance, neglect, or abuse by Owner, abnormal weather conditions unusual for warranty period, or incidents that are beyond GC's control.

Trees.

Shrubs.

Remove and replace dead planting materials immediately unless required to plant in the succeeding planting season.

Replace planting materials that are more than 25 percent dead or in an unhealthy condition at end of warranty period.

A limit of one replacement of each plant material will be required, except for losses or replacements due to failure to comply with requirements.

1.9 TREE AND SHRUB MAINTENANCE

A. Maintain trees and shrubs by pruning, cultivating, watering, weeding, fertilizing, restoring planting saucers, tightening and repairing stakes and guy supports, and resetting to proper grades or vertical position, as required to establish healthy, viable plantings. Spray as required to keep trees and shrubs free of insects and disease. Restore or replace damaged tree wrappings. Maintain trees and shrubs for the following period:

1. Maintenance Period: 30 days following Substantial Completion.

1.10 LAWN MAINTENANCE

Begin maintenance of lawns immediately after each area is planted and continue until acceptable lawn is established, but for not less than the following periods:

1. Sodded Lawns: 30 days after date of Substantial Completion.

Maintain and establish lawns by watering, fertilizing, weeding, mowing, trimming, replanting, and other operations. Roll, regrade, and replant bare or eroded areas and remulch to produce a uniformly smooth lawn.

Watering: Provide and maintain temporary piping, hoses, and lawn-watering equipment to convey water from sources and to keep lawns uniformly moist to a depth of 4 inches (100 mm).

1. Water lawn at the minimum rate of 1 inch (25 mm) per week.

Mow lawns as soon as there is enough top growth to cut with mower set at specified height for principal species planted. Repeat mowing as required to maintain specified height without cutting more than 40 percent of the grass height. Remove no more than 40 percent of grass-leaf growth in initial or subsequent mowings. Do not delay mowing until grass blades bend over and become matted. Do not mow when grass is wet.

Postfertilization: Apply fertilizer to lawn after first mowing and when grass is dry.

1. Use fertilizer that will provide actual nitrogen of at least 1 lb per 1000 sq. ft. (0.5 kg per 100 sq. m) of lawn area.

PART 2 - PRODUCTS

2.1 TREE AND SHRUB MATERIAL

Provide trees, shrubs and other plants of size, genus, species, and variety which are appropriate for the geographic area and local conditions of the site, and complying with recommendations and requirements of ANSI Z60.1 American Standard for Nursery Stock.

Provide deciduous trees (sized per plans) with branching, configuration recommended by ANSI Z60.1 for type and species

required. Provide single stem deciduous trees, balled and burlapped (B&B).

Provide deciduous shrubs (sized per plans) with not less than the minimum number of canes required by ANSI Z60.1 for type and height of shrub required. Provide deciduous shrubs, balled and burlapped (B&B).

Provide coniferous evergreen trees (sized per plans) and coniferous and broadleaf evergreen shrubs (sized per plans). Creeping or prostrate type conifers shall have a minimum spread of 18". Provide normal quality evergreens with well balanced form complying with requirements for other size relationships to the primary dimension shown. Provide balled and burlapped (B&B) evergreens.

2.2 GRASS MATERIALS

A. Sod: Certified turfgrass sod complying with ASPA specifications for machine-cut thickness, size, strength, moisture content, and mowed height, and free of weeds and undesirable native grasses. Provide viable sod of uniform density, color, and texture of the following turfgrass species, strongly rooted, and capable of vigorous growth and development when planted.

1. Species: As indicated on Drawings.

2.3 GROUND COVER

A. Provide plants established and well rooted in removable containers or integral peat pots.

2.4 MISCELLANEOUS LANDSCAPE MATERIALS

Anti-Desiccant: Emulsion type, film-forming agent designed to permit transpiration, but retard excessive loss of moisture from plants. Deliver in manufacturer's fully identified containers and mix in accordance with manufacturer's instructions.

Filtration/Separation Fabric: Water permeable filtration fabric of fiberglass or polypropylene fabric.

Wrapping: Tree-wrap tape not less than 4 inches wide, designed to prevent borer damage and winter freezing.

D. Stakes and Guys: Provide stakes and deadmen of sound new hardwood, treated softwood, or redwood, free of knot holes and other defects. Provide wire ties and guys of 2 strand, twisted, pliable galvanized iron wire, not lighter than 12 ga. With zinc-coated turnbuckles. Provide not less than 1/2 inch diameter rubber or plastic hose, cut to required lengths and of uniform color, material and size to protect tree trunks from damage by wires.

2.5 TOPSOIL

A. Topsoil: ASTM D 5268, pH range of 5.5 to 7, 4 percent organic material minimum, free of stones 1 inch (25 mm) or larger in any dimension, and other extraneous materials harmful to plant growth.

Topsoil Source: Reuse surface soil stockpiled on the site. Verify suitability of surface soil to produce topsoil meeting requirements and amend when necessary. Supplement with imported topsoil when quantities are insufficient. Clean topsoil of roots, plants, sods, stones, clay lumps, and other extraneous materials harmful to plant growth.

Topsoil Thickness:

Sod Grass: 6 inches.

Planter Beds: 12 inches.

Curb Islands: 18 inches.

2.6 SOIL AMENDMENTS

Lime: ASTM C 602, Class T, agricultural limestone containing a minimum 80 percent calcium carbonate equivalent, with a minimum 99 percent passing a No. 8 (2.36 mm) sieve and a minimum 75 percent passing a No. 60 (250 micrometer) sieve.

Peat Humus: Finely divided peat, so completely decomposed and free of fibers that its biological identity is lost. Provide in granular form, free of hard lumps and with pH range suitable for intended use.

Mulch: A five (5) pound sample of mulch shall be submitted to Architect prior to delivery to site. Mulch shall be free from deleterious materials and suitable for top dressing of trees, shrubs, or plants.

Commercial Fertilizer: Complete fertilizer of neutral character, with some elements derived from organic sources and containing following percentages of available plant nutrients:

1. For trees and shrubs, provide fertilizer with not less than 5 percent total nitrogen, 10 percent available phosphoric acid and 5 percent soluble potash.

2. For lawns, provide fertilizer with percentage of nitrogen required to provide not less than 1 pound actual nitrogen per 1,000 sq. Ft. of lawn area and not less than 4 percent phosphoric acid and 2 percent potassium. Provide nitrogen in a form that will be available to lawn during initial period of growth; at least 50 percent of nitrogen to be organic form.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas to receive landscaping for compliance with requirements and for conditions affecting performance of work of this Section. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.2 PLANTING SOIL PREPARATION

Before mixing, clean topsoil of roots, plants, sods, stones, clay lumps, and other extraneous materials harmful to plant growth.

Mix soil fertilizers with topsoil at rates indicated. Delay mixing fertilizer if planting does not follow placing of planting soil within a few days.

For tree pit or trench backfill, mix planting soil before backfilling and stockpile at site.

3.3 LAWN PLANTING PREPARATION

Limit subgrade preparation to areas that will be planted in the immediate future.

Loosen subgrade to a minimum depth of 4 inches (100 mm). Remove stones larger than 1 inch (25 mm) in any dimension and sticks, roots, rubbish, and other extraneous materials.

Spread planting soil mixture to depth required to meet thickness, grades, and elevations shown, after light rolling and natural settlement. Do not spread if planting soil or subgrade is frozen.

1. Place approximately 1/2 the thickness of planting soil mixture required. Work into top of loosened subgrade to create a transition layer and then place remainder of planting soil mixture.

Grade lawn and grass areas to a smooth, even surface with loose, uniformly fine texture. Roll and rake, remove ridges, and fill depressions to meet finish grades. Limit fine grading to areas that can be planted in the immediate future. Remove trash, debris, stones larger than 1 inch (25 mm) in any dimension, and other objects that may interfere with planting or maintenance operations.

Moisten prepared lawn areas before planting when soil is dry. Water thoroughly and allow surface to dry before planting. Do not create muddy soil.

Restore prepared areas if eroded or otherwise disturbed after fine grading and before planting.

3.4 EXCAVATION FOR TREES AND SHRUBS

- A. Pits and Trenches: Excavate with vertical sides and with bottom of excavation slightly raised at center to assist drainage. Loosen hard subsoil in bottom of excavation.

3.5 PLANTING TREES AND SHRUBS

- A. Set balled and burlapped stock plumb and in center of pit or trench with top of ball raised above adjacent finish grades as indicated. Place stock on setting layer of compacted planting soil.

Remove burlap and wire baskets from tops of balls and partially from sides, but do not remove from under balls. Remove pallets, if any, before setting. Do not use planting stock if ball is cracked or broken before or during planting operation.

Place backfill around ball in layers, tamping to settle backfill and eliminate voids and air pockets. When pit is approximately 1/2 backfilled, water thoroughly before placing remainder of backfill. Repeat watering until no more is absorbed. Water again after placing and tamping final layer of backfill.

- B. Set container-grown stock plumb and in center of pit or trench with top of ball raised above adjacent finish grades as indicated. Carefully remove containers so as not to damage root balls.

Place stock on setting layer of compacted planting soil.

Place backfill around ball in layers, tamping to settle backfill and eliminate voids and air pockets. When pit is approximately 1/2 backfilled, water thoroughly before placing remainder of backfill. Repeat watering until no more is absorbed. Water again after placing and tamping final layer of backfill.

- C. Set bare-root stock on cushion of planting soil. Spread roots without tangling or turning toward surface, and carefully work backfill around roots by hand. Puddle with water until backfill layers are completely saturated. Plumb before backfilling, and maintain plumb while working backfill around roots and placing layers above roots. Remove injured roots by cutting cleanly; do not break.

1. Set collar 1 inch (25 mm) below adjacent finish grades, unless otherwise indicated.

Dish and tamp top of backfill to form a 3-inch- (75-mm-) high mound around the rim of the pit. Do not cover top of root ball with backfill.

Wrap trees of 2-inch (50-mm) caliper and larger with trunk-wrap tape. Start at base of trunk and spiral cover trunk to height of first branches. Overlap wrap, exposing half the width, and securely attach without causing girdling. Inspect tree trunks for injury, improper pruning, and insect infestation and take corrective measures required before wrapping.

3.6 TREE AND SHRUB PRUNING

Prune, thin, and shape trees and shrubs as directed by Owner.

Prune, thin, and shape trees and shrubs according to standard horticultural practice. Prune trees to retain required height and spread. Unless otherwise directed by Owner, do not cut tree leaders; remove only injured or dead branches from flowering trees. Prune shrubs to retain natural character. Shrub sizes indicated are size after pruning.

3.7 TREE AND SHRUB GUYING AND STAKING

- A. Upright Staking and Tying: Stake trees of 2- through 5-inch (50- through 125-mm) caliper. Stake trees of less than 2-inch (50-mm) caliper only as required to prevent wind tip-out. Use a minimum of 2 stakes of length required to penetrate at least 18 inches (450 mm) below bottom of backfilled excavation and to extend at least 72 inches (1800 mm) above grade. Set vertical stakes and space to avoid penetrating balls or root masses. Support trees with 2 strands of tie wire encased in hose sections at contact points with tree trunk. Allow enough slack to avoid rigid restraint of tree.

3.8 MULCHING

Mulch backfilled surfaces of pits, trenches, planted areas, and other areas indicated.

Weed-Control Barriers: Install the following weed-control barriers according to manufacturer's recommendations, before mulching. Completely cover area to be mulched, lapping edges a minimum of 6 inches (150 mm).

1. DeWitt (or equal) 27mil, 4 oz./sq.yd.

Mulch: Apply the following average thickness of organic mulch and finish level with adjacent finish grades. Do not place mulch against trunks or stems.

1. Thickness: 3 inches (75 mm).

3.9 SODDING NEW LAWNS

Lay sod within 24 hours of stripping. Do not lay sod if dormant or if ground is frozen.

Lay sod to form a solid mass with tightly fitted joints. Butt ends and sides of sod; do not stretch or overlap. Stagger sod strips or pads to offset joints in adjacent courses. Avoid damage to subgrade or sod during installation. Tamp and roll lightly to ensure contact with subgrade, eliminate air pockets, and form a smooth surface. Work sifted soil or fine sand into minor cracks between pieces of sod; remove excess to avoid smothering sod and adjacent grass.

1. Anchor sod on slopes exceeding 3:1 (33.33%) with wood pegs spaced as recommended by sod manufacturer but not less than 2 anchors per sod strip to prevent slippage.

Saturate sod with fine water spray within 2 hours of planting. During first week, water daily or more frequently as necessary to maintain moist soil to a minimum depth of 1 1/2 inches (38 mm) below the sod.

3.10 CLEANUP AND PROTECTION

During landscaping, keep pavements clean and work area in an orderly condition.

Protect landscaping from damage due to landscape operations, operations by other contractors and trades, and trespassers. Maintain protection during installation and maintenance periods. Treat, repair, or replace damaged landscape work as directed.

- - - E N D - - -

SECTION 33 10 00 WATER
UTILITIES

PART 1 - GENERAL

1.1 DESCRIPTION:

- A. Underground water distribution system complete, ready for operation, including all appurtenant structures, and connections to both new building service lines and to existing water supply.

1.2 RELATED WORK:

Maintenance of Existing Utilities: Section 01 00 00, GENERAL REQUIREMENTS.

Excavation, trench widths, pipe bedding, backfill, shoring, sheeting, bracing: Section 31 20 00, EARTH MOVING.

Concrete: Idaho Standards for Public Works Construction - current edition (ISPWC) Division 700.

Protection of materials and equipment: Section 22 05 11, COMMON WORK RESULTS FOR PLUMBING.

1.3 DEFINITIONS:

Water Distribution: Pipelines and appurtenances which are part of the distribution system. The distribution system comprises the network of piping located throughout building areas and other areas of water use, including hydrants, valves, and other appurtenances used to supply water for domestic and fire-fighting/fire protection purposes.

Water Service Line: Pipe line connecting building piping to water distribution lines.

1.4 QUALITY ASSURANCE:

A. Products Criteria:

Multiple Units: When two or more units of the same type or class of materials or equipment are required, these units shall be product of one manufacturer.

Nameplate: Nameplate bearing manufacturer's name or identifiable trademark securely affixed in a conspicuous place on equipment or name or trademark cast integrally with equipment, stamped, or otherwise permanently marked on each item of equipment.

- B. Comply with the rules and regulations of the Public Utility having jurisdiction over the connection to Public Water lines and the extension, and/or modifications to Public Utility systems.

- C. Comply with all rules and regulations of Federal, State, and Local Department of Environmental Quality having jurisdiction over the design, construction, and operation of potable water systems.

All material surfaces in contact with potable water shall comply with NSF 61.

1.5 SUBMITTALS:

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA AND SAMPLES.
- B. Manufacturers' Literature and Data (Submit all items as one package):
(Ductile Iron Pipe and Polyvinyl Chloride (PVC) shall be in accordance with AWWA C600 and C605 respectively; and shall be provided to COTR for approval.)
- Piping.
 - Gaskets.
 - Valves.
 - Warning tape.
 - Meter.
 - Post indicator.
 - Valve boxes.
 - Joint restraint.
 - Disinfection products.
 - Cable ties.
 - Locate wire.
- C. Testing Certifications:
- Hydrostatic Testing.
 - Certification of Disinfection, including free chlorine residuals, and bacteriological examinations.

1.6 APPLICABLE PUBLICATIONS:

The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.

American National Standards Institute (ANSI/ASME):

- B16.1-98Cast Iron Pipe Flanges and Flanged Fittings
- B16.18Cast Bronze Solder Joint Pressure Fittings
- B16.26-88Cast Copper Alloy Fittings for Flared Copper
Tubes
- B40.100-98Pressure Gauges and Gauge Attachments

American Society for Testing and Materials (ASTM):

- A123-97 Zinc (Hot-Dip Galvanized) Coatings on Iron and
Steel Products
- A148M-03Standard Specifications for Steel Castings
- A242-00Standard Specifications for High Strength Low
Alloy Structural Steel AASHTO No. M161

- A307-02 Standard Specifications for Carbon Steel Bolts and Studs, 60,000 psi Tensile Strength
- A536-04 Standard Specifications for Ductile Iron Castings
- B61-02 Steam or Valve Bronze Castings
- B62-02 Composition Bronze or Ounce Metal Castings
- B88-02 Seamless Copper Water Tube
- B828 Standard Practice: Soldering and Brazing Copper Tube and fittings
- C32-04 Sewer and Manhole Brick (Made from Clay or Shale)
- C139-03 Concrete Masonry Units for Construction of Catch Basins and Manholes
- D1784-03 Standard Specifications for Rigid PVC Compounds and CPVC Compounds
- D1869-00 Standard Specifications for Rubber Rings for Asbestos Cement Pipe
- D2464-99 Standard Specifications for Threaded PVC Pipe Fittings, Schedule 80
- D2467-02 Standard Specifications for Poly (Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 80
- D3139-98 Joints for Plastic Pressure Pipes Using Flexible Elastomeric Seals
- F477-02e1 Elastomeric Seals (Gaskets) for Joining Plastic Pipe
- C32-04 Standard Specifications for Sewer Manhole Brick
- D. American Water Works Association (AWWA):
- B300-04 Hypochlorites
- B301-04 Liquid Chlorine
- C104-04 Cement Mortar Lining for Ductile Iron Pipe and Fittings for Water
- C105-99 Polyethylene Encasement for Gray and Ductile C.I. Piping for Water and Other Liquids
- C110-03 Ductile-Iron and Gray-Iron Fittings, 80 mm (3 Inches) Through 1200 mm (48 Inches) for Water and Other Liquids
- C111-01 Rubber-Gasket Joints for Ductile-Iron and Gray-Iron Pressure Pipe and Fittings

C115-99	Flanged Ductile-Iron and Gray-Iron Pipe with Threaded Flanges
C150-02	American National Standard for Thickness Design of Ductile Iron Pipe
C151-96	Ductile-Iron Pipe, Centrifugally Cast in Metal Molds or Sand-Lined Molds, for Water or Other Liquids
C153-00	Ductile-Iron Compact Fittings, 80 mm (3 inches) Through 300 mm (12 Inches) for Water and Other Liquids
C500-02	Gate Valves for Water and Sewerage Systems
C502a-95	Dry-Barrel Fire Hydrants
C503-97	Wet-Barrel Fire Hydrants
C508-01	Swing Check Valves for Waterworks Service, 2 Inches (50 mm) Through 24 Inches (600mm) NPS
C509-01	Resilient Seated Gate Valve for Water and Sewage System
C510-97	Double Check Valve Back-Flow Prevention Assembly
C511-97	Reduced Pressure Principle Back-Flow Prevention Assembly
C550-01	Protective Epoxy Interior Coatings for Valves and Hydrants
C600-01	Installation for Ductile-Iron Water Mains and Their Appurtenances
C605-94	Underground Installation of Polyvinyl Chloride (PVC) Pressure Pipe and Fittings for Water
C651-92	Disinfecting Water Mains
C800-01	Underground Service Line Valves and Fittings
C900-97	Polyvinyl Chloride (PVC) Pressure Pipe, 4 Inches Thru 12 Inches, for Water
C905-97	Polyvinyl Chloride (PVC) Pressure Pipe 14 Inches Thru 36 Inches
National Fire Protection Association (NFPA):	
24-95	Installation of Private Fire Service Mains and Their Appurtenances
291-01	Fire Flow Testing and Marking of Hydrants
1141-98	Fire Protection in Planned Building Groups
NSF International:	
14-03	Plastics Piping Components and Related Materials

61-02 Drinking Water System Components-Health Effects
(Sections 1-9)

American Welding Society (AWS):

A5.8-04 Brazing Filler Metal

Foundation for Cross-Connection Control and Hydraulic Research-2005

Copper Development Association's Copper Tube Handbook-2005

Geotechnical Engineering Report of VAMC Community Living Center and

Medical Imaging Center 500 West Fort Street Boise, Idaho by

Materials Testing & Inspection, Boise Idaho, Stamped and Sealed May

31, 2011 by Kevin Schroeder, P.G. and David O. Cram, P.E. and all

subsequent addenda.

Idaho Standards for Public Works Construction - Current Edition.

PART 2 - PRODUCTS

2.1 POLYVINYL CHLORIDE PIPE AND FITTINGS:

A. Class-Rated Polyvinyl Chloride (PVC) Pipe:

PVC pipe and accessories 100 mm to 356 mm (4 inches-14 inches) in diameter, AWWA C900 "Polyvinyl Chloride (PVC) Pressure Pipe", Class 200, DR 14, cast iron outside diameters, unless otherwise shown or specified.

PVC pipe and accessories 400 mm (16 inches) or larger, AWWA C905, "Polyvinyl Chloride Water Transmission Pipe", Class 235, DR 18, cast iron outside diameters unless otherwise shown or specified. Pipe and accessories shall bear the NSF mark indicating pipe size, manufacturer's name, AWWA and/or ASTM Specification number, working pressure and production code. Pipe and couplings shall be made in accordance with ASTM D1784.

PVC Pipe and Accessories Smaller than 100 mm (4 inches): Schedule 80, meeting the requirements of ASTM D-1785, Type 1, Grade 1. All exposed piping shall be CPVC meeting requirements of ASTM F441

B. Joints:

Pipe 75 mm (3 inches) and Greater in Diameter: Push-on type with factory installed solid cross section elastomeric ring meeting the requirements of ASTM F-477.

Pipe Less Than 75 mm (3 inches) in Diameter: Threaded (ASTM D-2464) or solvent welded (ASTM 2467). Use Teflon tape or liquid Teflon thread lubricant approved for use on plastic on all threaded joints.

C. Fittings:

Class-Rated Pipe 75 mm (3 inches) in Diameter and Greater: Ductile iron with mechanical joints conforming to the requirements of AWWA C153.

For Schedule 80 Pipe less than 75 mm (3 inches) in Diameter: Threaded or solvent weld. Threaded PVC fittings shall conform to ASTM D2464. CPVC fittings shall conform to ASTM F437 for threaded fittings and ASTM F439 for solvent weld fittings.

2.2 DUCTILE IRON PIPE AND FITTINGS:

Ductile iron pipe shall only be used in the event there is a separation problem from non-potable utilities and as directed by the COTR.

A. Ductile iron pipe, direct buried:

Provide ductile iron pipe conforming to the requirements of AWWA C151, Pressure Class 350 for Pipe 100 mm through 300 mm (4 inches through 12 inches) in diameter and 250, [] minimum for pipe larger than 300 mm (12 inches) in diameter, with standard thickness cement mortar lining interior, and interior asphaltic seal coat and exterior asphaltic coating, in accordance with AWWA and ANSI Standards.

Below Grade: Supply pipe in lengths not in excess of a nominal 6 m (20 feet) with rubber ring type push-on joints, mechanical joint or approved restrained joint. Provide flange joint pipe where shown on the drawings. Provide mechanical and restrained joint pipe with sufficient quantities of accessories as required for each joint.

When a polyethylene encasement over pipe, fittings, and valves is a requirement as indicated on the drawings, the material, installation and workmanship shall conform to applicable sections of AWWA C105. Make provisions to keep the polyethylene from direct exposure to sunlight prior to installation. Backfill following installation without delay to avoid exposure to sunlight.

- B. All Pipe Fittings: Ductile iron with a minimum pressure rating of 2400 kPa (350 psi). Fittings shall meet the requirements of ANSI and AWWA specifications as applicable. Rubber gasket joints shall conform to AWWA C111 for mechanical and push-on type joints. Ball joints shall conform to AWWA C151 with a separately cast ductile iron bell conforming to ASTM A148. Flanged fittings shall conform to AWWA C115 and be furnished flat faced and drilled to 850 kPa (125 psi) or 1725 kPa (250 psi) template in accordance with ANSI B16.1 with full faced gaskets.
- C. Provide cement mortar lining and bituminous seal coat on the inside of the pipe and fittings in accordance with AWWA C104. Provide standard asphaltic coating on the exterior.
- D. Provide a factory hydrostatic test of not less than 3.5 MPa (500 psi) for all pipe in accordance with AWWA C151.
- E. Provide non-detectable adhesive backed identification tape on top and sides of all buried ductile iron pipe, extended from joint to joint along the length of the pipe and have black lettering identifying the pipe service at no more than 300 mm (12 inch) intervals. According to service, the tape background color shall be as follows: potable water-blue.

2.3 VALVES:

Asbestos packing is not allowed.

Gate:

1. 75 mm (3 inches) and Larger: Resilient seated, ductile iron body, bronze mounted, inclined seats, non-rising stem type turning counter-clockwise to open, 1375 kPa (200 pound) WOG. AWWA C509. The resilient seat shall be fastened to the gate with stainless steel fasteners or vulcanizing methods. The interior and exterior shall be coated with thermo-setting or fusion epoxy coating in accordance with AWWA C550.

2. Operator:

Underground: Except for use with post indicators, furnish valves with 50 mm (2 inch) nut for socket wrench operation. Post indicator shall comply with the requirements of NFPA 24 and shall be fully compatible with the valve provided.

Above Ground and in Pits: Hand wheels.

3. Joints: Ends of valves shall accommodate, or be adapted to, pipe installed.

2.4 VALVE BOX:

- A. Cast iron extension box with screw or slide-type adjustment and flared base. Minimum thickness of metal shall be 5 mm (3/16 inch). Box shall be adapted, without full extension, to depth of cover required over pipe at valve location. Cast the word "WATER" in cover. Provide one "T" handle socket wrenches of 16 mm (5/8 inch) round stock long enough to extend 600 mm (2 feet) above top of deepest valve box.

2.5 POST INDICATOR VALVE:

- A. Valve: Valve shall conform to the specifications listed in Section 2.2 for gate valves. The Post Indicator shall conform to NFPA 24, and shall be fully compatible with the valve and all the supervisory switches.

2.6 PIPE SLEEVES:

- A. Ductile iron or zinc coated steel.

2.7 VAULTS (BACKFLOW PREVENTER OR METER): NONE REQUIRED**2.8 WATER METER: REFER TO PLUMBING SPECIFICATIONS****2.10 CAST IRON FRAME AND COVER, STEPS, ETC.:**

- A. Cast iron frame and cover, steps, etc. shall comply with State Department of Transportation standard details. Identify cover as "WATER".

2.11 POTABLE WATER:

- A. Water used for filling, flushing, and disinfection of water mains and appurtenances shall conform to Safe Drinking Water Act.

2.12 DISINFECTION CHLORINE:

Liquid chlorine shall conform to AWWA B301 and AWWA C651.

Sodium hypochlorite shall conform to AWWA B300 with 5 percent to 15 percent available chlorine.

Calcium hypochlorite shall conform to AWWA B300 supplied in granular form or 5.g tablets, and shall contain 65 percent chlorine by weight. **2.13 WARNING TAPE**

- A. Standard, 4-Mil polyethylene 76 mm (3 inch) wide tape, detectable type, blue with black letters, and imprinted with "CAUTION BURIED WATER LINE BELOW".

2.14 CABLE TIE

- A. Heavy duty cable ties shall have a minimum tensile strength of 175 pounds (80kgs), shall be a single self locking piece of suitable length and shall be installed using a manufactures cable tie gun to obtain proper tension.

2.15 LOCATE WIRE

- A. Wire shall be solid No. 12 AWG with blue insulation.

PART 3 - EXECUTION**3.1 BUILDING SERVICE LINES:**

- A. Install water service lines to point of connection within approximately 1500 mm (5 feet) outside of buildings to which such service is to be connected and make connections thereto. If building services have not been installed provide temporary caps.

3.2 REGRADING:

- A. Raise or lower existing valve and curb stop boxes and fire hydrants to finish grade in areas being graded.

3.3 PIPE LAYING, GENERAL:

Care shall be taken in loading, transporting, and unloading to prevent injury to the pipe or coatings. Pipe or fittings shall not be dropped. All pipe or fittings shall be examined before laying, and no piece shall be installed which is found to be defective. Any damage to the pipe coatings shall be repaired as directed by the COTR.

All pipe and fittings shall be subjected to a careful inspection just prior to being laid or installed. If any defective piping is discovered after it has been laid, it shall be removed and replaced with a sound pipe in a satisfactory manner at no additional expense to the Government. All pipe and fittings shall be thoroughly cleaned before laying, shall be kept clean until they are used in the work, and when installed or laid, shall conform to the lines and grades required.

All buried piping shall be installed to the lines and grades as shown on the drawings. All underground piping shall slope uniformly between joints where elevations are shown.

Contractor shall exercise extreme care when installing piping to shore up and protect from damage all existing underground water line and power lines, and all existing structures.

Do not lay pipe on unstable material, in wet trench, or when trench or weather conditions are unsuitable.

Do not lay pipe in same trench with other pipes or utilities unless shown otherwise on drawings.

Hold pipe securely in place while joint is being made.

Do not walk on pipes in trenches until covered by layers of earth well tamped in place to a depth of 300 mm (12 inches) over pipe.

Full length of each section of pipe shall rest solidly upon pipe bed with recesses excavated to accommodate bells or joints. Do not lay pipes on wood blocking.

Tees, plugs, caps, bends and hydrants on pipe installed underground shall be anchored. See section 3.7 "PIPE SUPPORTS".

Close pipe openings with caps or plugs during installation. Tightly cover and protect equipment against dirt, water and chemical, or mechanical injury. At completion of all work, thoroughly clean exposed materials and equipment.

Good alignment shall be preserved in laying. The deflection at joints shall not exceed that recommended by the manufacturer.

Warning tape shall be continuously placed 300 mm (12 inches) above buried water pipes.

3.4 PVC PIPE:

PVC piping shall be installed in strict accordance with the manufacturer's instructions and AWWA 605. Place selected material and thoroughly compacted to one foot above the top of the pipe and thereafter back filled as specified in Section 31 20 00, EARTH MOVING.

Locate Wire: Copper locate wire consisting of No. 12 AWG solid, single conductor, insulated copper wire shall be installed in the trench with all piping to permit location of the pipe with electronic detectors. The wire shall not be spiraled around the pipe but secured to the top of the pipe. Wire connections are to be made by stripping the insulation from the wire and soldering with rosin core solder. Solder joints shall be wrapped with rubber tape and electrical tape. At least every 300 m (1000 feet), provide a 2.3 kg (5 pound) magnesium anode attached to the main tracer wire by solder. The solder joint shall be wrapped with rubber

tape and with electrical tape. An anode shall be attached at the end of each line. Wire shall be installed per the drawings, wire shall penetrate into buildings with the pipe and shall have 18" [0.46m] of wire coiled and left secured in the building.

3.5 RESTRAINED JOINTS:

Sections of piping requiring restrained joints shall be constructed using pipe and fittings with restrained "locked-type" joints and the joints shall be capable of holding against withdrawal for line pressures 50 percent above the normal working pressure but not less than 1375 kPa (200 psi). The pipe and fittings shall be restrained push-on joints or restrained mechanical joints.

The minimum number of restrained joints required for resisting force at fittings and changes in direction of pipe shall be determined from the length of retained pipe on each side of fittings and changes in direction necessary to develop adequate resisting friction with the soil. Restrained pipe length shall be as shown on the drawings.

Thrust blocks shall not be permitted except as shown on the plans.

PVC pipe bell and spigot joints shall be restrained with the Uni-Flange Corp. Series 1350 Restrainer, Series 1500 by EBAA Iron, Inc. or approved equal. The restraining device and Tee head bolts shall be manufactured of high strength ductile iron meeting ASTM A536. Clamping bolts and nuts shall be manufactured of corrosion resistant high strength, low alloy steel meeting the requirements of ASTM A242.

Ductile iron mechanical joint fittings used with PVC pipe shall be restrained with UNI-Flange Corp. Series 1300 Restrainer, EBBA Iron, Inc, Series 2000PV Mechanical Joint Restrainer Gland, or approved equal. The restraining device and Tee head bolts shall be manufactured of high strength ductile iron meeting ASTM A-536. Clamping bolts and nuts shall be manufactured of corrosion resistant high strength, low alloy steel meeting the requirements of ASTM A242.

Mechanical joint valves and fittings shall be connected using a bolt-through positive restraint mechanism manufactured of U.S.A. ductile iron conforming to ASTM A536, 80-55-06. The device shall be Infact Corporation Foster Adaptor or equal.

Flexible ball joints, if required, shall be manufactured of ductile iron conforming to the material properties of ANSI/AWWA C153/A21.53. Flexible joints shall consist of a minimum deflection. Each flexible ball joint shall be pressure tested against its own restraint to a minimum of 350 psi. MEGALUG joint restraint shall be provided with each mechanical joint connection. All pressure containing parts shall be lined with a

minimum of 15 mils of fusion bonded epoxy, conforming to the applicable requirements of ANSI/AWWA C213 and shall be tested with a 1500 volt spark test conforming to stated specification. All flexible ball joints shall be FLEX-900, as manufactured by EBAA Iron, Inc., or approved equal.

3.6 PIPE SEPARATION:

A. Horizontal Separation-Water Mains and Sewers:

1. Water mains shall be located at least 3 m (10 feet) horizontally from any proposed drain, storm sewer, sanitary or sewer service connection.
2. Water mains may be located closer than 3 m (10 feet) to a sewer line when:
 - Local conditions prevent a lateral separation of 3 m (10 feet);
 - and
 - The water main invert is at least 450 mm (18 inches) above the crown of the sewer; and
 - The water main is either in a separate trench or in the same trench on an undisturbed earth shelf located one side of the sewer.
3. When it is impossible to meet (1) or (2) above, both the water main and drain or sewer shall be constructed of mechanical joint ductile iron pipe. Ductile iron pipe shall comply with the requirements listed in this specification section. The drain or sewer shall be pressure tested to the maximum expected surcharge head before back filling.

B. Vertical Separation-Water Mains and Sewers:

A water main shall be separated from a sewer so that its invert is a minimum of 450 mm (18 inches) above the crown of the drain or sewer whenever water mains cross storm sewers, sanitary sewers or sewer service connections. The vertical separation shall be maintained for that portion of the water main located within 10 feet horizontally of any sewer or drain crossed. A length of water main pipe shall be centered over the sewer to be crossed with joints equidistant from the sewer or drain.

Both the water main and sewer shall be constructed of slip-on or mechanical joint ductile iron pipe or PVC pipe equivalent to water main standards of construction when:

- It is impossible to obtain the proper vertical separations described in (1) above; or
- The water main passes under a sewer or drain.

A vertical separation of 450 mm (18 inches) between the invert of the sewer or drain and the crown of the water main shall be maintained where a water main crosses under a sewer. Support the sewer or drain lines to prevent settling and breaking the water main.

Construction shall extend on each side of the crossing until the perpendicular distance from the water main to the sewer or drain line is at least 3 m (10 feet).

3.7 SETTING OF VALVES AND BOXES:

Provide a surface concrete pad as shown on the plans to protect valve box when valve is not located below pavement.

Clean valve and curb stops interior before installation.

Set valve and curb stop box cover flush with finished grade.

Valves shall be installed plumb and level and in accordance with manufacturer's recommendations.

3.8 FLUSHING AND DISINFECTING:

A. Flush and disinfect new water lines in accordance with AWWA C651.

B. Initial flushing shall obtain a minimum velocity in the main of 0.75 m/sec (2.5 feet per second) at 40 PSI residual pressure in water main. The duration of the flushing shall be adequate to remove all particles from the line.

Pipe Diameter		Flow Required to Produce 2.5 ft/sec (approx.) Velocity in Main		Number of Hydrant Outlets			
				Size of Tap. in. (mm)			
				1 (25)	1 1/2 (38)	2 (51)	2 1/2-in (64 mm)
In	(mm)	gpm	(L/sec)	Number of taps on pipe			
4	(100)	100	(6.3)	1	--	--	1
6	(150)	200	(12.6)	--	1	--	1
8	(200)	400	(25.2)	--	2	1	1
10	(250)	600	(37.9)	--	3	2	1
12	(300)	900	(56.8)	--	--	3	2
16	(400)	1,600	(100.9)	--	--	4	2

The backflow preventers shall not be in place during the flushing.

C. The Contractor shall be responsible to provide the water source for filling, flushing, and disinfecting the lines. Only potable water shall be used, and the Contractor shall provide all required temporary pumps, storage facilities required to complete the specified flushing, and disinfection operations.

The Contractor shall be responsible for the disposal of all water used to flush and disinfect the system in accordance with all governing rules and regulations. The discharge water shall not be allowed to create a nuisance for activities occurring on or adjacent to the site.

The bacteriological test specified in AWWA C651 shall be performed by a laboratory approved by the Department of Environmental Quality of the State. The cost of sampling, transportation, and testing shall be the responsibility of the Contractor.

Re-disinfection and bacteriological testing of failed sections of the system shall be the sole responsibility of the Contractor.

Before backflow preventers are installed, all upstream piping shall be thoroughly flushed. **3.9 HYDROSTATIC TESTING:**

- A. Hydrostatic testing of the system shall occur prior to disinfecting the system.
- B. After new system is installed, except for connections to existing system and building, backfill at least 300 mm (12 inches) above pipe barrel, leaving joints exposed. The depth of the backfill shall be adequate to prevent the horizontal and vertical movement of the pipe during testing.
- C. Prior to pressurizing the line, all joint restraints shall be completely installed and inspected.
- D. If the system is tested in sections, and at the temporary caps at connections to the existing system and buildings, the Contractor shall provide and install all required temporary thrust restraints required to safely conduct the test.
- E. The Contractor shall install corporation stops in the line as required to purge the air out of the system. At the completion of the test, all corporation stops shall be capped.
- F. The Contractor shall perform pressure and leakage tests for the new system for 2 hours to 1375 kPa (200 psi). Leakage shall not exceed the following requirements.
 - Copper Tubing: No leaks.
 - Ductile Iron Pipe: AWWA C600. Provide to COTR office.
 - Polyvinyl Chloride (PVC) AWWA C605. Provide to COTR office.
- G. The Contractor shall perform preliminary pressure and leakage tests to verify construction before performing official test. Contractor shall notify COTR 2 working days prior to official test. The COTR or his representative shall witness the entire test.

3.10 LOCATE WIRE TESTING

A Locate wire shall be tested for conductivity by applying a charge at one end of the line and testing the other end or by using a locator and applying a charge to the line then tracing it along the surface. The Contractor shall perform preliminary tests to verify construction before performing official test. Contractor shall notify COTR 2 working days prior to official test. The COTR or his representative shall witness the entire test.

- - - E N D - - -

SECTION 33 30 00
SANITARY SEWERAGE UTILITIES

PART 1 - GENERAL

1.1 DESCRIPTION:

A. Outside, underground sanitary sewer system, complete, ready for operation, including all gravity flow lines, manholes, cleanouts, frames, covers, structures, appurtenances, and connections to new building and structure, service lines, existing sanitary sewer lines, and existing sanitary structures, and all other incidentals.

1.2 RELATED WORK:

Maintenance of Existing Utilities: Section 01 00 00, GENERAL REQUIREMENTS.

Excavation, Trench Widths, Pipe Bedding, Backfill, Shoring, Sheeting, Bracing: Section 31 20 00, EARTH MOVING; Dewatering: Section 31 23 19, DEWATERING.

Concrete Work Reinforcing, Placement and Finishing; Section 03 30 00, CAST-IN-PLACE CONCRETE, Section 03 30 53, MISCELLANEOUS CAST-IN-PLACE CONCRETE.

Fabrication of Steel Ladders: Section 05 50 00, METAL FABRICATIONS.

Protection of Materials and Equipment: Section 22 05 11, COMMON WORK RESULTS FOR PLUMBING.

Sanitary Sewer Pumping Facilities, Division 22, PLUMBING.

1.3 QUALITY ASSURANCE:

A. Products Criteria:

Multiple Units: When two or more units of the same type or class of materials or equipment are required, these units shall be products of one manufacturer.

Nameplates: Nameplate bearing manufacturer's name, or identifiable trademark, including model number, securely affixed in a conspicuous place on equipment, or name or trademark, including model number cast integrally with equipment, stamped, or otherwise permanently marked on each item of equipment.

B. Comply with the rules and regulations of the Public Utility having jurisdiction over the connection to Public Sanitary Sewer lines and the extension, and/or modifications to Public Utility Systems.

1.4 SUBMITTALS:

A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA AND SAMPLES.

- B. Manufacturers' Literature and Data: Submit the following as one package:
- Pipe, Fittings, and, Appurtenances.
 - Jointing Material.
 - Manhole and Structure Material.
 - Frames and Covers.
 - Steps and Ladders. 1.5

APPLICABLE PUBLICATIONS:

The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.

American Society for Testing and Materials (ASTM):

- A48/A48M-03Gray Iron Castings
- A536-84(2004) Ductile Iron Castings
- A615/A615M-06Deformed and Plain Carbon-Steel Bars for
Concrete Reinforcement
- A625/A625M-03Tin Mill Products, Black Plate, Single Reduced
- A746-03Ductile Iron Gravity Sewer Pipe
- C12-06 Installing Vitrified Clay Pipe Lines
- C76-05b/C76M-05bReinforced Concrete Culvert, Storm Drain and
Sewer Pipe
- C139-05 Concrete Masonry Units for Construction of Catch
Basins and Manholes
- C150-05Portland Cement
- C425-04Compression Joints for Vitrified Clay Pipe and
Fittings
- C478-06a/C478M-06aPrecast Reinforced Concrete Manhole Sections
- C700-05Vitrified Clay Pipe, Extra Strength, Standard
Strength, and Perforated
- C828-03 Low-Pressure Air Test of Vitrified Clay Pipe
Lines
- C857-95(2001) Minimum Structural Design Loading for
Underground Precast Concrete Utility Structures
- D698-00ae1 Laboratory Compaction Characteristics of Soil
Using Standard Effort (12,400 ft-lbf/ft³ (600 kN-
m/m³))
- D2321-05 Underground Installation of Thermoplastic Pipes
for Sewers and Other Gravity-Flow Applications

- D2412-02 Determination of External Loading
Characteristics of Plastic Pipe by Parallel-
Plate Loading
- D2992-01 Practice for Obtaining Hydrostatic or Pressure
Design Basis for Fiberglass (Glass-Fiber-
Reinforced Thermosetting-Resin) Pipe and
Fittings
- D3034-04a Type PSM Poly (Vinyl Chloride) (PVC) Sewer Pipe
and Fittings
- D3212-96a (2003) e1 ... Joints for Drain and Sewer Plastic Pipes Using
Flexible Elastomeric Seals
- D3261-03 Butt Heat Fusion Polyethylene (PE) Plastic
Fittings for Polyethylene (PE) Plastic Pipe and
Tubing
- D3350-05 Polyethylene Plastics Pipe and Fittings
Materials
- D4101-05a. Polypropylene Injection and Extrusion Materials
- F477-02e1 Elastomeric Seals (Gaskets) for Joining Plastic
Pipe
- F679-06 Poly (vinyl chloride) (PVC) Large-Diameter
Plastic Gravity Sewer Pipe and Fittings
- F714-05 Polyethylene (PE) Plastic Pipe (SDR-PR) Based on
Outside Diameter
- F794-03 Poly (Vinyl Chloride)(PVC) Ribbed Gravity Sewer
Pipe and Fittings Based on Controlled Inside
Diameter
- F894-05 Polyethylene (PE) Large Diameter Profile Wall
Sewer and Drain Pipe
- F949-03 Poly (Vinyl Chloride) (PVC) Corrugated Sewer
Pipe with Smooth Interior and Fittings
- C. American Water Works Association (AWWA):
- C105/A21.5-05 Polyethylene Encasement for Ductile Iron Pipe
Systems
- C110/A21.10-03 Ductile-Iron and Gray-Iron Fittings for Water
- C111/A21.11-00 Rubber Gasket Joints for Ductile Iron Pressure
Pipe and Fittings
- C115-99 Flanged Ductile-Iron Pipe with Threaded Flanges
- C116-03 Protective Fusion-Bonded Epoxy Coatings for the
Interior and Exterior Surfaces of Ductile Iron

- Pipe and Gray Iron Fittings for Water Supply Service
- C151-/A21.51-02 Ductile-Iron Pipe, Centrifugally Cast for Water
- C153-00 Ductile-Iron Compact Fittings for Water Services
- C508-01 Swing Check Valves for Waterworks, 2 inches (50 mm) Through 24 inches (600 mm) NPS
- C509-01 Resilient Seated Gate Valves for Water-Supply Service
- C515-01 Reduced-Wall, Resilient-Seated Gate Valves For Water Supply Service
- C512-04 Air Release, Air/Vacuum, and Combination Air Valves for Waterworks Service
- C550-05 Protective Epoxy Interior Coatings for Valves and Hydrants
- C600-05 Installation for Ductile-Iron Water Mains and Their Appurtenances
- C605-94 Underground Installation of Polyvinyl (PVC) Pressure Pipe and Fittings for Water
- C900-97 Polyvinyl Chloride (PVC) Pressure Pipe, 100 mm (4 inches) Through 300 mm (12 inches) for Water Distribution
- C905-97 Polyvinyl Chloride (PVC) Pressure Pipe and Fabricated Fittings, 350 mm through 1,200 mm (14 Inches through 48 Inches), for Water Transmission and Distribution
- C906-99 Polyethylene (PE) Pressure Pipes and Fittings, 100 mm through 1575 mm (4 Inches through 63 Inches), for Water Distribution
- American Association of State Highway and Transportation Officials (AASHTO):
- M198-05 Joints for Concrete Pipe, Manholes, and Precast Box Sections using Preformed Flexible Joint Sealants
- Uni-Bell PVC Pipe Association:
- Uni-B-6-98 Recommended Practice Low Pressure Air Testing of Installed Sewer Pipe
- Geotechnical Engineering Report of VAMC Community Living Center and Medical Imaging Center 500 West Fort Street Boise, Idaho by Materials Testing & Inspection, Boise Idaho, Stamped and Sealed May 31, 2011 by

Kevin Schroeder, P.G. and David O. Cram, P.E. and all subsequent addenda.

G. Idaho Standards for Public Works Construction - Current Edition.

PART 2 - PRODUCTS

2.1 PIPING:

A. Gravity Flow Lines (Pipe and Fittings):

Polyvinyl Chloride (PVC): Pipe and Fittings, 100 to 375 mm (4 to 15 inches) in diameter, shall conform to ASTM D3034, Type PSM, SDR 35. Pipe and fittings shall have elastomeric gasket joints providing a watertight seal when tested in accordance with ASTM D3212. Gaskets shall conform to ASTM F477. Solvent welded joints shall not be permitted.

Ductile Iron Pipe (DIP) for Sanitary Sewer:

Ductile iron pipe shall only be used in the event there is a separation problem from non-potable utilities and as directed by the COTR.

Shall conform to ASTM A746, thickness Class 51 unless otherwise shown or specified. Joints on pipe and fittings shall be push-on style and conform to AWWA C110 and AWWA C111, rated for 1.03 MPa (150 psi). Exterior coating shall be approximately 0.025 mm (1 mil) asphaltic coating as specified in ASTM A746. Interior lining shall be a catalyzed coal tar epoxy, having a minimum thickness of 0.60 mm (24 mils), a permeability rating of 0.13 perms, direct impact rating of 11.3 Nm (100 in-lbs), an abrasion resistance of 20 liters of sand per mil, and dielectric strength of 250 volts per mil. Pipe and fittings shall be polyethylene encased with 0.20 mm (8 mil) polyethylene sheeting per AWWA C105. Color of polyethylene encasement shall be green.

2.2 JOINTING MATERIAL:

A. Gravity Flow Lines:

1. Polyvinyl Chloride (PVC) Pipe (Gravity Use): Joints, ASTM D3212. Elastomeric gasket, ASTM F477.

2.3 CLEANOUT FRAMES AND COVERS:

- A. Frames and covers shall be gray iron casting conforming to ASTM C48. The frame and cover shall be rated for HS20-44 wheel loading, have a studded pattern on its cover, vent holes, and lifting slots. The cover shall fit firmly on the frame without movement when subject to vehicular traffic. The word "SEWER" shall be cast on the cover.

2.4 WARNING TAPE:

- A. Standard, .1mm (4Mil) polyethylene 76 mm (3 inch) wide tape detectable type, green with black letters and imprinted with "CAUTION BURIED SEWER LINE BELOW"

PART 3 - EXECUTION

3.1 BUILDING SERVICE LINES:

Install sanitary sewer service lines to point of connection within approximately 1500 mm (5 feet) outside of buildings where service is required and make connections. Coordinate the invert and location of the service line with the Contractor installing the building lines. Connections of service line to building piping shall be made after the new sanitary sewer system has been constructed, tested, and accepted for operation by the COTR. The Contractor shall install all temporary caps or plugs required for testing.

When building services have not been installed at the time when the sanitary sewer system is complete, provide temporary plugs or caps at the ends of all service lines. Mark the location and depth of the service lines with continuous warning tape placed 300 mm (12 inches) above service lines.

3.2 ABANDONED MANHOLES STRUCTURES AND PIPING:

Manholes and Structures Outside of Building Areas: Remove frame and cover, cut and remove the top to an elevation of 600 mm (2 feet) below finished grade. Fill the remaining portion with compacted gravel or crushed rock or concrete.

Manholes and Structures within Building Areas: Remove frame and cover and remove the entire structure and the base. Backfill with structural fill per Geotechnical Report.

Piping under and within 1500 mm (5 feet) of building areas shall be completely removed and backfill with structural fill per Geotechnical Report.

Piping outside of building areas shall have all ends of the piping at the limit of the abandonment and within structures and manholes, plugged with concrete, and abandoned in-place.

The Contractor shall comply with all OSHA confined space requirements while working within existing manholes and structures.

When the limit of the abandonment terminates in an existing manhole to remain, the flow line in the bench of the manhole to the abandoned line shall be filled with concrete and shaped to maintain the flowline of the lines to remain.

3.3 REGRADING:

A. Raise or lower existing manholes and structures frames and covers, cleanout frames and covers and valve boxes in regraded areas to finish

grade. Carefully remove, clean and salvage cast iron frames and covers. Adjust the elevation of all existing cleanout pipe risers, and reinstall the cap or plug. Reset cast iron frame and cover, grouting below and around the frame. Install concrete collar around reset frame and cover as specified for new construction.

During periods when work is progressing on adjusting manholes or structures cover elevations, the Contractor shall install a temporary cover above the bench of the structure or manhole. The temporary cover shall be installed above the high flow elevation within the structure, and shall prevent debris from entering the wastewater stream.

The Contractor shall comply with all OSHA confined space requirements when working within existing structures. **3.4 CONNECTIONS TO EXISTING VA OWNED MANHOLES:**

During construction of new connections to existing manholes, it shall be the sole responsibility of the Contractor to maintain continued sanitary sewer service to all buildings and users upstream. The contractor shall provide, install, and maintain all pumping, conveyance system, dams, weirs, etc. required to maintain the continuous flow of sewage. All temporary measures required to meet this requirement shall be subject to the review and approval of the COTR prior to performing the work.

Core existing structure, install pipe at the design invert. Install an elastomeric gasket around the pipe, and grout the interstitial space between the pipe and the core.

The bench of the manhole shall be cleaned and reshaped to provide a smooth flowline for all pipes connected to the manhole.

Connections and alterations to existing manholes shall be constructed so that finished work conforms as nearly as practicable to the applicable requirements specified for new manholes, including concrete and masonry work, cutting and shaping.

3.5 PIPE SEPARATION:

A. Horizontal Separation - Water Mains and Sewers:

Existing and proposed water mains shall be at least 3 meters (10 feet) horizontally from any proposed gravity flow and pressure (force main) sanitary sewer or sewer service connection.

Gravity flow mains and pressure (force) mains may be located closer than 3 meters (10 feet) but not closer than 1.8 m (6 feet) to a water main when:

- a. Local conditions prevent a lateral separation of ten feet; and

The water main invert is at least 450 mm (18 inches) above the crown of the gravity sewer or 600 mm (24 inches) above the crown of the pressure (force) main; and

The water main is in a separate trench separated by undisturbed earth.

3. When it is impossible to meet (1) or (2) above, both the water main and sanitary sewer main shall be constructed of push-on or mechanical joint ductile iron pipe. The pipe for the sanitary sewer main shall comply with the specifications for pressure (force) mains, and the water main material shall comply with Section 33 10 00, WATER UTILITIES. The sewer shall be pressure tested as specified for pressure (force) mains before backfilling.

B. Vertical Separation - Water Mains and Sewers at Crossings:

Water mains shall be separated from sewer mains so that the invert of the water main is a minimum of 600 mm (24 inches) above the crown of gravity flow sewer or 1200 mm (48 inches) above the crown of pressure (force) mains. The vertical separation shall be maintained within 3 meters (10 feet) horizontally of the sewer and water crossing. When these vertical separations are met, no additional protection is required.

In no case shall pressure (force) sanitary main cross above, or within 600 mm (24 inches) of water lines.

When it is impossible to meet (1) above, the gravity flow sewer may be installed 450 mm (18 inches) above or 300 mm (12 inches) below the water main, provided that both the water main and sewer shall be constructed of push-on or mechanical ductile pipe. Pressure (Force) sewers may be installed 600 mm (24 inches) below the water line provided both the water line and sewer line are constructed of ductile iron pipe. The pipe for the sewer shall conform to the requirements for pressure sewers specified herein. Piping for the water main shall conform to Section 33 10 00, WATER UTILITIES.

The required vertical separation between the sewer and the water main shall extend on each side of the crossing until the perpendicular distance from the water main to the sewer line is at least 3 meters (10 feet).

3.6 GENERAL PIPING INSTALLATION:

- A. Lay pipes true to line and grade. Gravity flow sewer shall be laid with bells facing upgrade. Pressure (force) mains shall have the bells facing the direction of flow.

Do not lay pipe on unstable material, in wet trench or when trench and weather conditions are unsuitable for the work.

Support pipe on compacted bedding material. Excavate bell holes only large enough to properly make the joint.

Inspect pipes and fittings, for defects before installation. Defective materials shall be plainly marked and removed from the site. Cut pipe shall have smooth regular ends at right angles to axis of pipe.

Clean interior of all pipe thoroughly before installation. When work is not in progress, open ends of pipe shall be closed securely to prevent entrance of storm water, dirt or other substances.

Lower pipe into trench carefully and bring to proper line, grade, and joint. After jointing, interior of each pipe shall be thoroughly wiped or swabbed to remove any dirt, trash or excess jointing materials.

Do not lay sewer pipe in same trench with another pipe or other utility. Sanitary sewers shall cross at least 600 mm (2 feet) below water lines.

Do not walk on pipe in trenches until covered by layers of bedding or backfill material to a depth of 300 mm (12 inches) over the crown of the pipe.

Warning tape shall be continuously placed 300 mm (12 inches) above sewer pipe

Install gravity sewer line in accordance with the provisions of these specifications and the following standards:

1. Polyvinyl Chloride (PVC) Piping: ASTM D2321.

3.8 SEWER AND MANHOLE SUPPORTS, CONCRETE CRADLES:

A. Reinforced concrete as detailed on the drawings. The concrete shall not restrict access for future maintenance of the joints within the piping system.

3.9 INSPECTION OF SEWERS:

A. Inspect and obtain the COTR's approval. Thoroughly flush out before inspection. Lamp test between structures and show full bore indicating sewer is true to line and grade. Lip at joints on the inside of gravity sewer lines are not acceptable.

3.10 TESTING OF SANITARY SEWERS:

A. Gravity Sewers and Manholes (Select one of the following):

1. Air Test: Vitrified Clay Pipe ASTM C828. PVC Pipe, Uni-Bell Uni-B-6. Clean and isolate the section of sewer line to be tested. Plug or cap the ends of all branches, laterals, tees, wyes, and stubs to be included in the test to prevent air leakage. The line shall be pressurized to 28 kPa (4 psi) and allowed to stabilize. After

pressure stabilization, the pressure shall be dropped to 24 kPa (3.5 psi) greater than the average back-pressure of any groundwater above the sewer. The minimum test time shall be as specified in Uni-Bell Uni-B-6.

2. Exfiltration Test:

Subject pipe to hydrostatic pressure produced by head of water at depth of 900 mm (3 feet) above invert of sewer at upper manhole under test. In areas where ground water exists, head of water shall be 900 mm (3 feet) above existing water table. Maintain head of water for one hour for full absorption by pipe body before testing. During one hour test period, measured maximum allowable rate of exfiltration for any section of sewer shall be 11 L (3.0 gallons) per hour per 30 m (100 feet).

If measurements indicate exfiltration is greater than maximum allowable leakage, take additional measurements until leaks are located. Repair and retest.

- - - E N D - - -

SECTION 33 40 00
STORM DRAINAGE UTILITIES

PART 1 - GENERAL

1.1 DESCRIPTION:

A. This section specifies construction of outside, underground storm sewer systems. The storm sewer systems shall be complete and ready for operation, including all drainage structures, frames, grate and covers, connections to new buildings, structure service lines, existing storm sewer lines and existing drainage structures and all required incidentals.

1.2 RELATED WORK:

Maintenance of Existing Utilities: Section 01 00 00, GENERAL REQUIREMENTS.

Excavation, Trench Widths, Pipe Bedding, Backfill, Shoring, Sheeting, Bracing: Section 31 20 00, EARTH MOVING.

Concrete Work, Reinforcing, Placement and Finishing: Section 03 30 00, CAST-IN-PLACE CONCRETE.

Fabrication of Steel Ladders: Section 05 50 00, METAL FABRICATIONS.

Protection of Materials and Equipment: Section 22 05 11, COMMON WORK RESULTS FOR PLUMBING.

1.3 QUALITY ASSURANCE:

A. Products Criteria:

Multiple Units: When two or more units of the same type or class of materials or equipment are required, these units shall be products of one manufacturer.

Nameplates: Nameplate bearing manufacturer's name, or identifiable trademark, securely affixed in a conspicuous place on equipment, or name or trademark cast integrally with equipment, stamped, or otherwise permanently marked on each item of equipment.

B. Comply with the rules and regulations of the Public Utility having jurisdiction over the connection to public storm sewer lines and the extension, and/or modifications to Public Utility systems.

1.4 SUBMITTALS:

Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA AND SAMPLES.

Manufacturers' Literature and Data: Submit the following as one package:

Piping.

Jointing material.

Manhole, inlet and catch basin material.
 Frames and covers.
 Sand and grease trap.
 Resilient connectors and downspout boots.
 Drain rock and sand gradation from pit.
 Filter fabric. 1.5

APPLICABLE PUBLICATIONS:

The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.

American Society for Testing and Materials (ASTM):

A48-03/A48M-03Gray Iron Castings
 A536-84(2004) Ductile Iron Castings
 A615-05/A615M-05Deformed and Plain-Billet Steel Bars for
 Concrete Reinforcement
 A655-04e1/A655M-04e1... Reinforced Concrete D-Load Culvert, Storm
 Drain and Sewer Pipe
 A742-03/A742M-03Steel Sheet, Metallic Coated and Polymer
 Precoated for Corrugated Steel Pipe
 A760-01a/A760M-01a Corrugated Steel Pipe, Metallic-Coated for
 Sewers and Drains
 A762-00/A762M-00Corrugated Steel Pipe, Polymer Precoated for
 Sewers and Drains
 A798-01/M798M-01 Installing Factory-Made Corrugated Steel Pipe
 for Sewers and Other Applications
 A849-00 Post-Applied Coatings, Pavings, and Linings for
 Corrugated Steel Sewer and Drainage Pipe
 A929-01/A929M-01Steel Sheet, Metallic Coated by the Hot Dip
 Process for Corrugated Steel Pipe
 C76-05a/C76M-05a Reinforced Concrete Culvert, Storm Drain and
 Sewer Pipe
 C139-03 Concrete Masonry Units for Construction of Catch
 Basins and Manholes
 C150-04ae1Portland Cement
 C443-05/C443M-05Joints for Concrete Pipe and Manholes, Using
 Rubber Gaskets
 C478-03a/C478M-03aPrecast Reinforced Concrete Manhole Sections
 C506-05/C506M-05Reinforced Concrete Arch Culvert, Storm Drain
 and Sewer Pipe

C507-05a/C507M-05a ... Reinforced Concrete Elliptical Culvert, Storm Drain and Sewer Pipe

C655-04e1/C655M-04e1 .. Reinforced Concrete D-Load Culvert, Storm Drain and Sewer Pipe

C1433-04e1/C1433M-04e1 .Precast Reinforced Concrete Box Sections for Culverts, Storm Drains and Sewers

C828-03Low-Pressure Air Test of Vitrified Clay Pipe Lines

C857-95(2001)Minimum Structural Design Loading for Underground Precast Concrete Utility Structures

C923-02/C923M-02 Resilient Connectors between Reinforced Concrete Manhole Structures, Pipes and Materials

C924-02/C924M-02 Testing Concrete Pipe Sewer Lines by Low Pressure Air Test Method

C1103-03/C1103M-03 ... Joint Acceptance Testing of Installed Precast Concrete Pipe Sewer Lines

D698-00ae1Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft³ (600 kN-m/m³))

D1056-00 Flexible Cellular Materials-Sponge or Expanded Rubber

D2412-02 Determination of External Loading Characteristics of Plastic Pipe by Parallel Plate Loading

D2321-04e1Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity Flow Applications .

D3034-04a Type PSM Poly (Vinyl Chloride) (PVC) Sewer Pipe and Fittings

D3212-96a(2003)e1 Joints for Drain and Sewer Plastic Pipes Using Flexible Elastomeric Seals

D3350-04 Polyethylene Plastics Pipe and Fittings Materials

D4101-05a Polypropylene Injection and Extrusion Materials

F477-02e1 Elastomeric Seals (Gaskets) for Joining Plastic Pipe

F679-03 Poly (Vinyl Chloride) (PVC) Large-Diameter Plastic Gravity Sewer Pipe and Fittings

F714-05 Polyethylene (PE) Plastic Pipe (SDR-PR) Based on Outside Diameter

- F794-03 Poly (Vinyl Chloride)(PVC) Profile Gravity Sewer
Pipe and Fittings Based on Controlled
Inside Diameter
- F894-98a Polyethylene (PE) Large Diameter Profile Wall
Sewer and Drain Pipe
- F949-03 Poly (Vinyl Chloride) (PVC) Corrugated Sewer
Pipe with Smooth Interior
- F1417-92(2005) Installation Acceptance of Plastic Gravity Sewer
Lines Using Low-Pressure Air

NOTE: ASTM test methods shall be the current version as of the date of
advertisement of the project.

American Association of State Highway and Transportation Officials
(AASHTO):

- HB17Standard Specifications for Highway Bridges
- M190-04Bituminous Coated Corrugated Metal Culvert Pipe
and Pipe Arches
- M198-05Joints for Circular Concrete Sewer and Culvert
Pipe Using Flexible Watertight Gaskets
- M294-04 Corrugated Polyethylene Pipe, 300-1500 mm (12 to
60 inches) Diameter

Geotechnical Engineering Report of VAMC Community Living Center and
Medical Imaging Center 500 West Fort Street Boise, Idaho by
Materials Testing & Inspection, Boise Idaho, Stamped and Sealed May
31, 2011 by Kevin Schroeder, P.G. and David O. Cram, P.E. and all
subsequent addenda.

Idaho Standards for Public Works Construction - Current Edition.

PART 2 - PRODUCTS

2.1 PIPING:

A. Gravity Lines (Pipe and Appurtenances):

1. Polyvinyl Chloride (PVC):

Pipe and Fittings, Type PSM PVC Pipe, shall conform to ASTM D3034,
Type PSM, SDR 35. Pipe and fittings shall have elastomeric gasket
joints providing a watertight seal when tested in accordance with
ASTM D 3212. Gaskets shall conform to ASTM F 477. Solvent welded
joints shall not be permitted.

Pipe and fittings, smooth wall, corrugated or ribbed PVC, shall
conform to the following:

- 1) Pipe and fittings shall conform to ASTM F949 corrugated sewer
pipe with a smooth interior. The corrugated outer wall shall be

fused to the smooth interwall at the corrugation valley. Pipe and fitting shall have a smooth bell, elastomeric joints conforming to ASTM D 3212, and shall have a minimum pipe stiffness of 345 kPa (50 psi) at 5 percent deflection, when tested in accordance with ASTM D 2412. Corrugation shall be perpendicular to the axis of the pipe to allow gaskets to be installed on field cut sections of pipe without the requirement for special fittings.

Ribbed wall PVC pipe and fittings shall conform to ASTM F794, Series 46. Ribbed sewer pipe with smooth interior pipe and fittings shall have a smooth bell, elastomeric joints conforming to ASTM D 3212, and shall have a minimum pipe stiffness of 320 kPa (46 psi) when tested in accordance with ASTM D 2412, at 5 percent vertical deflection. Joints shall not leak at 7.6 m (25 feet) of head under 5 percent deflection.

Solid wall pipe and fittings shall conform to ASTM F 679, SDR 26 pipe and fittings shall gaskets conforming to ASTM F 477, and shall be able to withstand a hydrostatic pressure of 345 kPa (50 psi).

2. High Density Polyethylene (HDPE):

- a. Smooth Double Wall PE Pipe: Shall be ADS N12 ST IB or approved equal.

2.2 JOINTING MATERIAL:

A. Polyvinyl Chloride (PVC) Pipe:

- 1. PVC Plastic Pipe: Joints shall comply with ASTM D3212, Elastomeric Gaskets shall comply with ASTM F477 and as recommended by the manufacturer.

2.3 MANHOLES, INLETS, SAND & GREASE INTERCEPTOR AND CATCH BASINS:

- A. Sand & Grease Interceptor shall be an Amcor 1000-gallon (3800 liters) unit or engineer approved equal.

2.4 WARNING TAPE:

- A. Standard, 4-Mil polyethylene 76 mm (3 inch) wide tape detectable type, purple with black letters, and imprinted with "CAUTION BURIED STORM SEWER BELOW".

PART 3 - EXECUTION

3.1 EXCAVATION FOR STORM DRAINS AND DRAINAGE STRUCTURES:

- A. Excavation of trenches and for appurtenances and backfilling for storm drains, shall be in accordance with the applicable portions of Section 31 20 00, EARTH MOVING.

3.2 PIPE BEDDING:

- A. The bedding surface of the pipe shall provide a firm foundation of uniform density throughout the entire length of pipe. Pipe bedding shall be per the design drawings.

3.3 GENERAL PIPING INSTALLATION:

- A. Lay pipes true to line and grade. Gravity flow sewer shall be laid with bells facing upgrade.
- B. Do not lay pipe on unstable material, in wet trench or when trench and weather conditions are unsuitable for the work.
- C. Support pipe on compacted bedding material. Excavate bell holes only large enough to properly make the joint.
- D. Inspect pipes and fittings, for defects before installation. Defective materials shall be plainly marked and removed from the site. Cut pipe shall have smooth regular ends at right angles to axis of pipe.
- E. Clean interior of all pipe thoroughly before installation. When work is not in progress, open ends of pipe shall be closed securely to prevent entrance of storm water, dirt or other substances.
- F. Lower pipe into trench carefully and bring to proper line, grade, and joint. After jointing, interior of each pipe shall be thoroughly wiped or swabbed to remove any dirt, trash or excess jointing materials.
- G. Do not lay sewer pipe in same trench with another pipe or other utility.
- H. Do not walk on pipe in trenches until covered by layers of shading to a depth of 300 mm (12 inches) over the crown of the pipe.
- I. Install gravity sewer line in accordance with the provisions of these specifications and the following standards:
 - Reinforced Concrete Pipe: Not used.
 - Polyvinyl Chloride (PVC) Piping: ASTM D2321.
 - High Density Polyethylene (HDPE) Piping: Comply with manufacturer's recommendations with gasketed joints.
 - Corrugated Metal Pipe: Not used.
- J. Warning tape shall be continuously placed 300 mm (12 inches) above storm sewer piping.

3.4 REGRADING:

Raise or lower existing manholes and structures frames and covers in regraded areas to finish grade. Carefully remove, clean and salvage cast iron frames and covers. Reset cast iron frame and cover, grouting below and around the frame. Install concrete collar around reset frame and cover as specified for new construction.

During periods when work is progressing on adjusting manholes or structures cover elevations, the Contractor shall install a temporary cover above the bench of the structure or manhole. The temporary cover shall be installed above the high flow elevation within the structure, and shall prevent debris from entering the wastewater stream.

- C. The Contractor shall comply with all OSHA confined space requirements when working within existing structures.

3.5 MANHOLES, INLETS, SAND & GREASE INTERCEPTOR AND CATCH BASINS:

A. General:

1. Rectangular Structures:

Reinforced concrete structures shall be installed in accordance with Division 03, CONCRETE of these specifications.

Structures provided with a base section shall be set on a 200 mm (8 inches) thick aggregate base course compacted to a minimum of 95 percent of the maximum density as determined by ASTM D 698. Set precast section true and plumb. Seal all joints with pre-form flexible gasket material.

2. Do not build structures when air temperature is 0 degrees C (32 degrees F), or below.
3. Install manhole frames and covers on a mortar bed, and flush with the finish pavement. Frames and covers shall not move when subject to vehicular traffic. Install a concrete collar around the frame to protect the frame from moving until the adjacent pavement is placed. In unpaved areas, the rim elevation shall be 50 mm (2 inches) above the adjacent finish grade. Install a 200 mm (8 inches) thick, by 300 mm (12 inches) concrete collar around the perimeter of the frame. Slope the top of the collar away from the frame.

3.9 INSPECTION OF SEWERS:

- A. Inspect and obtain the COTR's approval. Thoroughly flush out before inspection. Lamp between structures and show full bore indicating sewer is true to line and grade. Lip at joints on inside of sewer is prohibited.

3.10 TESTING OF STORM SEWERS:

A. Gravity Sewers (Select one of the following):

Air Test: Concrete Pipes conform to ASTM C924, Plastic Pipes conform to ASTM F1417, and all other pipe material conforms to ASTM C828 or C924, after consulting with pipe manufacturer. Testing of individual joints shall conform to ASTM C1103.

Exfiltration Test:

- a. Subject pipe to hydrostatic pressure produced by head of water at depth of 900 mm (3 feet) above invert of sewer at upper manhole under test. In areas where ground water exists, head of water shall be 900 mm (3 feet) above existing water table. Maintain head of water for one hour for full absorption by pipe body before

testing. During 1 hour test period, measured maximum allowable rate of exfiltration for any section of sewer shall be 11L (3.0 gallons) per hour per 30 m (100 feet).

- b. If measurements indicate exfiltration is greater than maximum allowable leakage, take additional measurements until leaks are located. Repair and retest.

- - - E N D - - -